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Prof. Sterry Hunt, on Coals and Mineral Oils of America.

[Concluded from page 64.]

The State of Michigan includes a coal basin with an area of not less than 6,700 square miles, but the beds of coal which it contains are few, thin, and of inferior quality. For this reason, and from the fact that the State is cheaply supplied with superior coals from Pennsylvania and Ohio, the coal of Michigan is worked only to a small extent for local consumption, the estimated production for 1772 being but 30,000 tons. The Illinois coal basin, which underlies the greater part of that State, and extends into the western parts of Indiana and Kentucky, has an area of not less than 47,000 square miles. Along its eastern and western borders in Clay county, Indiana, and near St. Louis, are found deposits of an excellent block coal like that of Ohio, adapted for iron smelting, but with this exception the coals of this great basin are generally sulphurous and inferior in quality, and command in the market of Chicago a price much below those of Pennsylvania and Ohio. Chicago received in 1873 over 1,600,000 tons of coal, of which about two-fifths only were from the adjacent coal-field, the remainder being brought from the two States just named. The first working of coal in Illinois dates from 1810, and the production of the State for 1872 was equal to 3,000,000 tons, while Indiana furnished 800,000, and that portion of the coal-field which lies in Western Kentucky 300,000 tons.

The coals of the great field west of the Mississippi, which extends through Iowa, Missouri, Kansas, and Arkansas, are mostly of inferior quality and in thin beds, but are of great local importance in these scarcely wooded regions. In the State of Arkansas, moreover, there are found beds of a superior semi-bituminous coal, approaching to anthracite in its character. Further westward, in the Rocky Mountains and thence to the Pacific coast, from the confines of Mexico to Canada, are extensive deposits of tertiary coals or lignites, which, though inferior in quality to the coals of the Appalachian basin, are, in the absence of better fuel, employed for generating steam and for domestic purposes. They are, however, very variable in quality, and some beds have of late been found which are fit for the manufacture of illuminating gas, and are even capable of yielding a coke suitable for metallurgical processes. These coals are mined in Utah, Colorado, and Wyoming, and again on the Pacific coast in California, Oregon, and Washington Territory. Of the coal supply of San Francisco in 1873, which equaled 441,000 tons, about sixty per cent. came from these deposits along the western coast, the remainder being from Australia, England, and the Eastern States.

The petroleum industry of the United States was in its beginning closely connected with coal, since it was the production of oils from bituminous coals which led the way to the utilization of the native mineral oils. It had long been known that tar and oily matters could be extracted from coal and from shales impregnated with oily matter, by subjecting them to a high temperature, these substances, although not existing ready- formed in the coals, being generated by the decomposing action of heat. A product thus obtained was known to apothecaries more than a century ago by the name of British oil; and in 1834 experiments on a large scale were made in France by Selligue to manufacture illuminating oils by the distillation of shales, and with partial success. In 1846 similar results were obtained by Gesner in New Brunswick; and in 1850 Atwood, of Boston, prepared a lubricating oil from coal-tar. At the same time Young, of Glasgow, was experimenting, and in 1850 introduced into the market, under the name of paraffine oil, a product from cannel-coal. The first works for this manufacture in the United States were established on Long Island in 1854, under Young's patents for manufacturing oils from the Boghead coal brought from Scotland, or from American coals. From this point the industry spread rapidly, and in 1855 and 1856 works for the distillation of oils from coals were erected in Kentucky, Ohio, and Pennsylvania, as well as along the Atlantic seaboard, where the principal material employed was the mineral from Scotland just named.

In January, 1860, there were in the United States not less than forty factories, the total daily production of which was about 500 barrels, chiefly of burning oil. This was sold in the market with the trade name of kerosene, or simply as coal oil; and lamps suitable for burning it having been devised, it became widely used. But this industry of the distillation of coal was destined to have a very short duration, for the oil wells of Pennsylvania, opened in 1859, furnished in 1860 not less than 500,000 barrels of petroleum—a production far exceeding that of the coal distilleries. It was soon found that from this mineral oil products could be extracted in all respects similar to those from coal, and the result was that from this time the manufacture of coal oil was abandoned, and the works which had been erected for this purpose were changed to petroleum refineries.

The early history of petroleum is curious. Known and employed for burning from remote antiquity in the Old World, no process for its purification had been devised, and it was therefore at best but an indifferent and cheaper substitute for animal and vegetable oils. The first attempts to refine it for commercial purposes are believed to have been made by Young, of Glasgow, in 1847, on petroleum got from Derbyshire, in England, from which he prepared a lubricating oil, and it was the exhaustion of this supply which led him to improve the methods for the extraction of oils from coal.

Meanwhile, in the United States, the existence of sources of mineral oil had been known to the Indians of New York and Pennsylvania, who prized it as a medicine, for which purpose it became familiar to the early European colonists under the name of Seneca-oil. It appears to have been an object of research to the aborigines ages ago, since in the oil regions of Western Pennsylvania are found pits or wells apparently dug for the purpose of collecting the oil, carefully timbered, and affording from the growth of the forest upon the site evidences of an antiquity of from 500 to 600 years. As early as 1819, in boring for brine on the Muskingum river, in Ohio, from a depth of 400 feet were obtained large quantities of mineral oil, which was a source of great annoyance to the salt-makers. At this time attempts were made to use the oil for illumination, but, from the want of proper lamps, it was not found to be adapted to the purpose. In 1854 the successful manufacture of oils from coal caused attention to be drawn to the possibility of utilizing these native oils, and the Pennsylvania Oil Company was formed for the purpose of manufacturing the petroleum found at Oil Creek, in Venango county, Pennsylvania. The chemical investigation of the material was committed to Prof. B. Silliman, Jr., and his report to the company, which appeared in April, 1855, has been the point of departure for the immense industry of petroleum which has grown up within the last twenty years. In this report was described the conversion of the crude petroleum by fractional distillation into products differing in density and in volatility, the manufacture from it of a burning oil of great illuminating power, of an oil capable of supporting a low temperature and fitted for lubrication, and also of paraffine. He farther showed the importance of distillation in a current of highly heated steam, and noticed the breaking up of heavier into lighter oils by continued heat—processes which have since assumed a great importance in the manufacture of petroleum.

Notwithstanding these remarkable results, little was effected for some years; the supply of petroleum was limited to that which could be gathered from the surface of the water in the locality, and from its cost it could not compete with the product of the distillation of coal. At length an attempt was made to repeat the early experiment of the Muskingum salt works, and a well was bored by Drake, the superintendent of the Pennsylvania Oil Company, from which, at a depth of seventy-two feet, a supply of oil amounting to ten barrels or 400 gallons a day was obtained, which was sold for 55 cents a gallon. This was in August, 1859, and the successful trial was soon followed by many others not less so. The history of the wild excitement and speculation which followed this discovery, and the great accession of wealth to the region, is familiar to all. Wells were soon sunk which yield-

ed from 100 to as much as 2000 barrels of oil daily, often without the labor of pumping. Of one well it is recorded that it afforded 450,000 barrels of oil in a little over two years, while another is said to have given not less than 500,000 barrels in a twelvemonth. Petroleum was soon discovered not only over a wide district in Pennsylvania, but in Eastern Ohio and in parts of West Virginia and Kentucky, and even in Indiana, as well as in Western Canada. In 1860 the production rose to 500,000 barrels of forty gallons each, and for the decade ending with 1870 it amounted to not less than 35,273,000 barrels of crude oil. Of this by far the greater part came from Pennsylvania, for of the 6,500,000 barrels produced in 1870, not less than 5,569,000 were from that State, the production of about 3000 wells, which is an average of only about five barrels daily for each well.

The wells in Venango county, where this industry began, were generally from 600 to 800 feet in depth, but with the partial exhaustion of these the scene of operations has been removed to more southern districts, where the oil supplies are found at greater depths; and the wells in Butler county, now the great seat of production, are from 1200 to 1500 feet deep. The crude oil is carried from the wells to the points of refining or of shipment through iron pipes. Some of these lines are fifteen and twenty miles in length, and one is in process of construction from Butler county to Pittsburgh, a distance of about forty miles. It has even been proposed to convey the oil by a series of conduits and reservoirs across the mountains to Philadelphia.

The processes for refining the crude petroleum and preparing from it various commercial products have been perfected by much chemical skill. The loss in refining amounts to about 10 per cent., and the average product of illuminating oil from the crude petroleum of Pennsylvania is about 65 per cent. The other products are dense lubricating oils, light naphthas, and paraffine or mineral wax, of which a barrel of crude oil yields about five pounds.

The abundance of the Pennsylvania petroleum and the skillful manner in which it is refined have led to a general exportation of these products to every part of the civilized world. Already in 1861 we find the shipments of petroleum from the United States to foreign ports equal to nearly 28,000 barrels of 40 gallons each, and for the ten years ending with 1870 the exportation was 14,465,000 barrels. By far the greater part of this was shipped in the refined state, and its average price for the term of ten years was estimated at 25 cents a gallon, thus representing an aggregate value of over $144,000,000. The increase in the amount exported has been regular and constant. That for the calendar year 1870 was 3,495,800 barrels; for 1772, 3,754,000; for 1875, 5,937,041; and for 1874, 5,878,578 barrels, of which about nine-tenths is refined oil.

This large increase in the exports of the last ten years shows the very considerable augmentation in production which has followed late discoveries in Pennsylvania. These have been attended by a great reduction in price. From 55 cents the gallon, at which the crude oils from the wells was sold, it soon fell to 20 cents, and to 60 or 70 cents for the refined oil. In 1872 its price in New York had fallen below 24 cents, in 1852 to below 19, and in 1874 to a small fraction over 15 cents, the crude oil in New York having fallen in the same three years from about 13 to less than 6 cents the gallon. Of crude oil 43½ gallons are counted to a barrel, yet its price in Western Pennsylvania in 1874 was from 60 to 75 cents a barrel at the wells, and from 80 cents to $1 at the delivery pipes. Even at the present reduced prices the annual value of the petroleum product of the country is very great.

The export for 1874, chiefly of refined oil, at the mean price of 13.09 cents the gallon, equals $30,825,268. The present annual consumption of the United States is estimated at 1,500,000 barrels of refined petroleum, which, added to the export for 1874, gives a total of 7,378,000 barrels of refined oil. The estimated production of crude oil for 1874 is not less than 10,687,930 barrels, or 29.282 daily. Already in 1870, when the production was considerably less than at present, it was said that the petroleum wells of the United States yielded in a week an amount of oil greater than the entire annual production of the whale-fisheries of New England at the time of their greatest prosperity. American petroleum has now almost entirely replaced the products of these fisheries, and furnished to the whole world a cheap and admirable means of illumination. Petroleum abounds in many parts of the Old World, but attempts to compete with the product of Pennsyleania have not been successful. The same remark will apply to the petroleum found in Santa Barbara county, California, which is refined there to a limited extent for domestic use, and yields, besides a good burning oil, one peculiarly fitted for lubricating purposes.

Improved Gas Engine.

The cleanliness and compactness of gas engines, and the facility which they offer for the generation of power for short periods and at irregular intervals, has led to their being exten-ively used in many cases, when steam would be the reverse of economic, if not altogether inapplicable; and a large number of inventors have turned their attention to their improvement. Among the most recent inventions is that of Mr. G. W. Daimler, of Millheim, which consists in the use of a water-jacketed cylinder open to the atmosphere at both ends, and containing, firstly, a working piston connected by a piston-rod, cross-head, and connecting-rods to an engine-shaft; and, secondly, two other pistons, one on each side of the working piston. These latter pistons are loose in the cylinder and operate thus. Assuming the working piston to be at the end of its back stroke, resting closely against the back loose piston, and with a space intervening between it and the front loose piston, into which space an explosive mixture of air and gas, or petroleum vapor has been drawn from an inlet valve; then, on the ignition of the explosive charge, the front loose piston is propelled rapidly to the front end of the cylinder, where it is retained by an arrangement of expanding wedges, which wedge it tight in a conical enlargement at the ends of the cylinder.

A partial vacuum being thus produced in the cylinder by the expansion and cooling of the products of combustion, the working piston, and with it the back loose piston, is caused by atmospheric pressure to travel towards the front end of the cylinder. The working piston carries a sliding rod, which, as it approaches the front loose piston, comes in contact therewith, and also with the back loose piston, and thus arrests the motion of the latter, while the working piston continuing its motion to the end of its stroke causes a space to be formed between it and the back loose piston, into which a fresh charge of gas and air is drawn through a second supply valve. The charge being ignited, the motions of the several pistons are effected in the manner above described, but in the contrary order and direction, the front loose piston which was before wedged tight being again freed so as to return with the working piston by being pushed outwards by the latter, whereby the wedges in becoming free are contracted by springs. The working piston in approaching the front loose piston expels the products of combustion from between them through a discharge valve in the cylinder, and buffers are provided at each end of the cylinder, against which the working piston presses the loose piston, so as to expel all the gas, and insure a close contact between them.

The supply of gas and air to the cylinder is effected by a conical valve at each end having passages in its stem through which gas and air enter the valve-box when the valve is open. The ignition of the charge in the cylinder is effected by a disc on the valve stem which, as the valve closes, carries a portion of flame from a gas jet into the valve chamber, at the same time cutting off the communication between the valve chamber and the gas jet. The supply valves are opened at the proper times for the admission of gas and air by means of cams on the engine-shaft, and are closed by the action of springs. For working the engine by petroleum vapor instead of coal gas, the liquid petroleum is caused to flow in a small stream into a pipe in the water-jacket of the cylinder, where it becomes vaporized by the heat of the water, and is then conducted to the supply valve. The air supply is in this case also caused to pass first through a pipe in the cylinder jacket to become heated.

The power of the engine is regulated by means of a governor in such manner that when the speed of the engine is too great the supply of combustible gas is entirely cut off, and the engine performs its strokes without any explosion of gas and air until the speed is again reduced. This is effected by means of a valve, the stem of which is raised or lowered by the governor so as to bring a head upon the stem either above the projection on the face of the bevel-wheel on the engine-shaft (in which case the valve is open), or below the projection, in which case an incline on the projection closes the valve. A flap valve is also provided in the supply pipe for preventing more than the requisite quantity of gas from entering the cylinder. The piston and piston-rod are cooled by the circulation of water therein, the water being made to enter from the water-jacket of the cylinder into a branch pipe on the front end of the piston-rod, the branch pipe having a small receptacle on its end, which is made to open a valve in the water-jacket when the piston-rod arrives at its end strokes.—*London Mining Journal.*

The Commission on Water Supply of the City of Philadelphia.

The Commission of Civil Engineers appointed by the Mayor met together at the Franklin Institute, on the 29th of June, and organized by the election of W. Milnor Roberts, as chairman. The ordinance of Councils makes it the duty of this commission to examine and report upon the present and future water supply of the city of Philadelphia. The commission consists of the following gentlemen: W. Milner Roberts, C. E., of New York; Hon. Wm. J. McAlpine, C. E., of Albany; Col. Julius W. Adams, C. E., of Brooklyn; S. W. Roberts, C. E., of Philadelphia; Wm. R. Morris, C. E., of Philadelphia; who, according to the ordinance, act in conjunction with Dr. W. H. McFadden, Chief Engineer of the City Water Department.

We learn that these gentlemen, ever since their organization as a commission, have been almost constantly engaged in the performance of the very important and responsible duty which has been assigned to them. They have visited and examined all the pumping warks at Fair Mount, Spring Garden, Belmont, Roxborough, Chestnut Hill, and Kensington, and the Fairmount, Belmont, Roxborough, Chestnut Hill, Mount Airy, Germantown, Lehigh Avenue and Corinthian reservoirs; also the large unfinished reservoir in East Park. They have also made special examinations of the Wissahickon Valley, of the Valley of the Perkiomen, and of the proposed reservoir site in that valley, in company with Mr. Birkinbine, former chief engineer of the Water Department, who recommended its construction, in reports made by him about ten years ago.

The members of the commission, by invitation of Mr. Gowen, president of the Reading Railroad Company, who kindly placed special engines at their disposal, made a very satisfactory visit to the upper Schuylkill, accompanied by James F. Smith, chief engineer of the Schuylkill Navigation Company, who showed and explained the company's reservoirs at Tumbling Run. They made an examination of the Delaware river, accompanied by Mayor Stokley, as far up as Beverly, a few miles above the city boundary, making special observations at all important sewage and creek outlets. Afterward, members of the commission examined the Delaware river above tide, particularly at New Hope, Easton, and the Delaware Water Gap. They visited Ewing's Spring,

which is 2½ miles from New Hope. They also made an examination of the Schuylkill river, between Fairmount dam and Spring Mills, passing through the locks of the Navigation Company, and visited the fine spring near Spring Mills.

The commission have requested the chief engineer of the Water Department to have rapid surveys made from the Perkiomen, and from the vicinity of New Hope to the city, to enable them to judge correctly of the nature and extent of the obstacles in the way of possible lines of conduit. Meanwhile, the members, whether in session or otherwise, are almost constantly engaged in collecting and collating data to aid them in their investigations.

It is well known to those who are familiar with the water system of Philadelphia, that it is one of peculiar complication: owing not so much to the topography as to the comparatively late consolidation into one, of a number of separate municipal or civil corporations, each having its own water supply arrangement.

The object of the commission is to ascertain what is most advantageous for the immediate demands of the city: and, which is still more important, what is the best plan or plans for the future. While much preliminary work has already been accomplished by the commission, some time will necessarily be required to arrange the various data, which are daily accumulating, as well as for their complete study and discussion before any definite conclusions can be reached.

We learn that at the request of the commission our fellow townsman, Mr. James Haworth, appeared before them and presented some views, in addition to those he has before made public in several pamphlets.

The chief engineer of the Water Department, and his assistants, have been kept busy in preparing statistics of various kinds, relating to the subject, for the use of the commission, and in making measurements of the flow of certain streams. It is obvious that the matter is in the hands of gentlemen competent to fulfill the duty assigned to them, and that they have entered upon their labors with a determination to make their investigations in the most thorough manner.—*Journal of Franklin Institute.*

The Pelouze and Audouin Condenser.

During December, 1872, Messrs. Pelouze and Audouin received their first French patent for a new method of condensation based upon Halley's vesicular theory of vapors, and upon the principle that liquefaction of the globules thus held in suspension is brought about by contact of the particles either with solid surfaces, or with each other.

After many months' trial of their machine at a station of the Paris Gas Company, and some discussion of its theory and merits before the French Academy of Sciences, and by the Gas Journals of France, an illustrated article, translated from the "Comptes Rendus," was published in the London *Journal of Gas-Lighting*, of October 7th, 1873, and most favorably commented upon by the Editor.

In January, 1874, the performance of an experimental machine induced the San Francisco Gas-Light Company to construct a large condenser, with 20-inch connections, which has been working most satisfactorily since April of that year, the first of its class in America.

On May 26, 1874, Messrs. Pelouze & Audouin received their patent from the United States; while another patent was granted to myself, for certain novelties in construction on July 21st, of the same year.

As a result of the erection of the San Francisco condenser, a correspondence arose between the patentees which led to the uniting of their interests, and the recent allotment to myself of the work of introducing the perfected condenser to the notice of American gas-makers.

"A Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas," which brings the record of this great industry down to the latest dates, is now reaching its close. In chapter XXXII of this admirable work (London *Gas-Light Journal*, September 29, 1874) occurs the following sentences:

"Amongst the most novel and interesting contrivances for the purpose of condensing the objectionable vapors of gas, is the method patented by Messrs. Pelouze and Audouin—both names honorably associated with the science of gas-lighting—which differs entirely from any hitherto mentioned. * * Report speaks very favorably of it, and it may be regarded as a beautiful scientific instrument."

Coal gas usually leaves the hydraulic main at a temperature of from 110° to 140° Fahrenheit, heavily charged with the vapors of tar and ammoniacal liquor.

The cooling process effected by the usual condensers arrests much of these liquids; but a notable percentage of the liquefiable matter passes on in the form of a sort of fine spray composed of an infinite number of microscopic globules.

Various forms of apparatus—for the most part bulky and costly—are used to disentangle these troublesome little particles from the flow of gas; yet it is rare to find a gas work where the bottom of the purifiers, or even the lime itself, is free from coal tar, or gas liquor, or both together.

More than this—what tar and gas liquor is thus separated by the older appliances is frequently so diluted that it is suffered to run to waste, thus reducing the value of the residuary products to an important extent.

Every gallon of tar now thrown away would save six-tenths of a bushel of coke in the furnaces; while each gallon of gas liquor has an intrinsic money value, however blind we may be to the fact. These liquids also, unless properly and completely arrested, block and impede the final processes of purification at every step.

In regard to the question of using coal tar to heat the retorts, it may not improperly be observed that the form of tar-furnace given by Mr. Buist of Halifax is the most simple and efficient yet presented. A bench can be altered from coke-fuel to tar-fuel in two hours, and returned to coke in twenty minutes. A bench of five retorts will consume 90 gallons of tar per diem, against 54 bushels of coke, so that coal-tar is worth 60 cents per gallon when coke sells for 10c. per bushel.

It will be found where a very powerful multitubular condenser is followed by a Pelouze and Audouin condenser, that the latter will arrest from ¾-gallon to 1½-gallons of tar per ton of coal worked, which in most works runs to waste, or is worse than wasted. In very many works the existing condensers are so inefficient that the value of the new machine is doubled; while in one gas-work, with old-fashioned condensers of enormous power, *but using the Rocky Mountain lignites*, this machine actually separates 4 gallons per ton. How viscous and obstinate the tar, and how perfect the action of the Pelouze and Audouin condenser must be in this case, I leave to the consideration of my readers.

It will be incredible to many that coal tar is so intimately entangled as to pass through a washer, and through three lime boxes of great surface, appearing in large quantities in the street-drips; but such a phenomenon does occasionally occur, even in works of recent construction.

One stereotyped objection to the use of coke as filling for scrubbers is that the interstices choke so completely with tar as to leave only small sinuous passages for the gas. That this is valid is proven by the action of several London companies, who run a train of scrubbers until the back-pressure has been worked up to three inches by the accumulation of tar in the coke.

And in the purifiers it is rare to find the bottom trays of lime free from tar, which interferes with the proper action of the lime, and increases back-pressure.

The fact is that coal-tar is a worse enemy than the old school of gas-makers will readily admit; while a Pelouze and Audouin condenser, in conjunction with a few tar-furnaces, converts it into a pecuniary friend which can never become "a drug in the market."

The value of ammoniacal liquor will never be thoroughly understood until the veil of mystery is removed from its conversion into the saleable forms. Because the sulphate has hitherto been considered as the necessary base of *all* the commercial preparations, few companies are ambitious enough to look beyond the production of that salt. So few, in fact, are making even the sulphate that it is imported regularly from Europe; while 600 American companies are destroying a million dollars' worth of meters per annum with one-quarter of their ammonia, while the other three-quarters passes off through their waste drains.

Now, any instrument which shall hasten the sale of aqua-ammonia, *on tap*, by every grocery in the country, and shall reduce the water, *by reducing the ammonia*, in the scrubbers, is fairly entitled to attention. The manufacture of the high grades of aqua-ammonia, *without the use of acids*, is simple enough, though outside the scope of this article. The French experiments gave a ton-yield from the Pelouze and Audouin condenser of 3 gallons of gas-liquor, of 7·9 Baaume. This is equal to $\left(\frac{152}{152-7\cdot9}\right)$ a density of 1·055, or say 22-ounce liquor; a result which will seem almost incredible to any one at all familiar with the behavior of ammonia carried in *cold* gas. In other words, about 40 per cent. of the ammonia carried at the scrubber inlet is arrested by the interposition of the Pelouze and Audouin condenser, and the quantity of water necessary in the scrubber is reduced by a similar percentage.

These are the results of the experience of fifty gas-works, during long periods, with the Pelouze and Audouin condenser.

The gas-flow is broken into a multitude of jets of one-sixteenth of an inch in diameter, which play incessantly against blank plates facing the apertures at suitable distance. Two repetitions of this impact or percussion suffice, practically, to burst the liquid envelopes of the little globules; the liquids pass from vaporous to massive form, and (after trickling down the faces of the plates) find their way in a steady stream out of the overflow.

The condensing drum accommodates the number of its working jets to the volume passing, and is only 12 inches diameter by 12 inches deep, for a machine to pass 150,000 cubic feet per day.

The pressure at which the jets should work varies, according to the coal and distillatory methods employed, from 5 to 25-tenths, the higher pressures being necessary in the case of the lignites; but in any case the back-pressures of the other apparatus find such simultaneous reduction that the duty of the exhauster is not appreciably increased.

The condenser works just as well without, as with, an exhauster; and may be placed with equal advantage upon the vacuum, or upon the pressure, side of that machine.

The Paris Gas Company, which sent out during 1874 the enormous volume of 5,700 millions cubic feet, uses the condenser at each of its ten heavy stations; and the verdict of every gas-manager who employs it is in its favor.

The main features of the Patent of May 26, 1874, are the combined bye-pass, and the differential gauge. The former cheapens the machine to the purchaser, while it adds to its compactness and efficiency; the latter is a three-fold, non-oscillating gauge, which is admired by such engineers as have examined it.

In conclusion, nothing but my absolute knowledge of the merits of the Pelouze and Audouin condenser could have induced me to share its fortunes, and to guarantee its construction and performance.

JAS. R. SMEDBERG.

New York City Water-Supply.

The *World* s ys—

No further action will be taken by the Croton Water Department in regard to an increased supply of water till the issue of new bonds under chapter 477 of the

Laws of 1875 is authorized by the Board of Aldermen. No action can be taken till the board moves in the matter, as all available moneys for new work in the department are exhausted. The regular appropriation made yearly by the Board of Estimate and Apportionment is devoted exclusively to the ordinary maintenance of the department and cannot be applied even to the extension of a street main to new dwelling-houses. In the absence of a new appropriation for construction serious inconvenience and hardship is being daily felt in the new wards. Evidence on this subject is continually accumulating at the office of the Commissioners of Public Works. These two wards have been heretofore dependent on the natural supply of water, and previous to the annexation most dwelling-houses were provided with a cistern or well. Since that time, however, it has been generally anticipated that the Croton water mains would be introduced in a short time, and no provisions were made for any other supply. As there has been a very considerable increase of population immediately following the annexation, great inconvenience has resulted among all concerned, the cisterns and wells of a single dwelling-house often having to furnish a water-supply to half a dozen. In the present drought these sources are becoming rapidly exhausted, the only other supply being mains which have been run provisionally into some parts of these wards for safety against fire and for other purposes. The department is now constantly receiving applications for permission to draw from these mains to fill cisterns at a distance from them.

WATER NEEDS DOWN TOWN.

The growth of population in the lower wards of the city has led to a somewhat similar result by overtaxing the means of supplying water. A street main which was amply large enough to convey water to a street where each house has a single family, proves wholly inadequate where the street is lined with tenement houses. Aside from this serious difficulty the supply which can at present be afforded is believed by the engineers of the department to be sufficient. The city is at present using more than three times as much as is supplied to London proportionally, and more than twice the actual water-supply of Paris. The drought began this year two weeks earlier than usual, and is likely to last as late as it ever does. The extra supplies have been thus far drawn from the water behind the Croton River dam, and not from the reserve reservoirs.

The head of water on the city supply has been accordingly diminished, and in the higher part of the city the water does not rise as high as it did, reaching only the first or second stories where it before reached the third or fourth. In no case has it yet been cut off from any street or house, and as the supply to the two highest points in the city, Murray Hill and Ninetieth street, is still kept up from "high-surface" water, no inconvenience has been caused by the diminution of pressure.

Value of Safety-Lamps.

None of the accidents from explosions in Mr. Moore's district happened through meteorological influences, nor were they of such a nature that any scientific training would have prevented. They were all due to defective discipline, and might have been avoided by taking the precaution of testing or working with a safety lamp, as required by the special rules. It will be noted that the sufferers were either firemen or were working along with firemen, with the exception of the accident at Blantyre, and in that case the men were experienced miners, and were the only persons working in the seam; they were all on day wages, and had no object to gain by neglecting to use a safety-lamp. The result of all explosions in Scotland seems to prove that they will continue to happen unless some other precautions are taken. It is a striking fact that in those collieries in Northumberland and Durham where the workings give off fire-damp freely few explosions occur; while in this district, where there is really very little gas given off by the workings, seven persons were killed last year and 32 injured. In the former case the workings are lighted with safety-lamps exclusively, whereby the risk of explosion is reduced to imperfection of safety-lamps; whereas, in Scottish collieries the rule is to work with naked or uncovered lights, and the exception to use safety-lamps. There are in this district about 3,000,000 tons a year raised where the workings give off a little fire damp, two-thirds of which are worked with naked lights, and as miners require extra payment per ton for working with safety-lamps, the cost of raising coal would be greatly increased if their use was imperative. It is, therefore, a serious matter to propose that all collieries where fire damp has been seen should be lighted by safety-lamps alone; but he is of opinion that nothing short of a law prohibiting the use of naked lights and blasting with gunpowder in mines where fire damp has been seen will reduce deaths or accidents from explosions of fire-damp to a minimum. Indeed, these remarks would apply to all districts, for nearly all explosions happen through carelessness of the workmen, or from some temporary derangement of the ordinary conditions of the colliery, whereby gas is unexpectedly brought in contact with naked lights, where it was thought safe to use them. Experiments have conclusively proved that under certain conditions the Davy lamp ceases to be safe, but these conditions so rarely occur in practice that he believes 99 per cent. of all explosions occur from the exposure of the gas to naked lights.—*British Government Mine-Inspection.*

SAFETY-LAMPS NOT ALWAYS SAFE.

And why? Twenty-two large explosions have taken place in English coal mines since the year 1866; among these seventeen took place at the moment of the firing of a blast at a distance. Galloway conceived from this the suspicion that a violent sound-wave might be capable of pushing the flame through the wire gauze of the safety-lamp, and thus ignite the inflammable gas around. It was known that when explosive gases are drawn through a wire gauze with a velocity of ten to twelve feet per second, the flame penetrates and ignites them; but it was not known that a sound-wave would do the same thing, and this is what Galloway has proved by experiment. He placed a safety-lamp in an explosive mixture, and fired a pistol at a distance of twenty feet, or ignited a box filled with a mixture of coal-gas and oxygen; in either case a large flame was projected through the wire gauze out of the safety-lamp, and ignited the surrounding gas. He found no difference when the gas was separated from the air by means of a thin membrane, which would not permit air currents to pass, but only transmit the sound wave. The experiment was varied by transmitting the sound wave through a tube twenty feet long, and of which the axis was directed toward the safety-lamp; closing this tube with an elastic membrane made no difference whatever. He therefore came to the conclusion that a blast in a coal mine may make all the safety-lamps useless, while it explains the fact that an explosion in one part of a mine is often immediately followed by another explosion at a distant point.

The Oil Regions of McKean and Cattaraugus Counties.

We have published the news in previous issues, of the discovery of oil wells in considerable numbers and of considerable value in the counties bordering on the New York State line. Considerable activity prevails in that region. The first well was sunk ten years ago, and produced some oil; but no further development was made until about three years ago, when a second well was sunk about a thousand feet, and abandoned. This well was sunk deeper a few months ago, and yielded about fifteen barrels per day; it now yields two. There have been, in all, six wells sunk in this region, all of which are now yielding oil, the highest quantity produced by any being one hundred barrels, and the average daily yield from the six wells being about thirty barrels. Quite a number of wells are being sunk, the completion of which will more fully settle the value of the territory. The town of Bradford, within the limits of which all the wells have thus far been found, borders on New York State exactly due northeast from Butler, which is the general direction of the oil-producing belt.—*National Oil Journal.*

PETROLEUM EXPORTS.—The exports of petroleum from New York, Philadelphia and Baltimore for Europe during the week ending July 19th, 1875, amounted in crude equivalent to 218,832 barrels, a daily average of 31,266 barrels, as against 284,816 barrels for the same week last year, a daily average of 40,688 barrels. The charters on the 19th inst. amounted in crude equivalent to 590,155 barrels. The total exports for Europe from the three ports this year up to July 19th in crude equivalent were 3,085,750 barrels, against 3,648,125 barrels, same time last year, a falling off this year thus far of 662,375 barrels, and if the same rate of difference should continue to the close of the year it would amount to one million barrels, about 18 per cent. decrease.

PETROLEUM PRODUCTION.—The Oil City *Derrick* reports 47 new wells completed in June, with an aggregate daily yield of 1,263 bbls., and an average of 27 bbls. per well. It also reports 208 new wells drilling July 1st.

APPROACHING EXHAUSTION.—The well reported on our new list of wells at Bradford, Pa., is important as added evidence that the extent of oil producing territory is far greater than generally supposed. The idea that the old and tested territory is all there is, is utterly fallacious and has not an argument to uphold it. —*National Oil Journal.*

The Antiseptic Properties of Compressed Air.

The investigations of M. Paul Bert relative to the properties of compressed air, details of which have already been inserted in these columns, were the means of discoveries as unexpected as they were important. So far from accelerating respiration and consequently vital activity, as was predicted, the gas caused an enfeeblement of all the natural functions, and, in cases of sufficient compression, death. With pure oxygen, like results were observed, with the difference, however, that the pressure might be five times less than that of compressed air in order to produce a given effect.

Starting from the point thus reached, and adopting the theory according to which fermentations are ascribed to the development of minute elementary organisms, M. Bert has recently undertaken to determine the question of whether air or oxygen in a compressed state does not constitute an antiseptic agent. The experiments made have led him to an affirmative conclusion. Meat submitted for a month to the action of compressed air became yellow and acquired a slightly acid reaction, but all its nutritive properties were found thoroughly preserved. The investigator cooked and ate mutton chops similarly treated and was unable to observe any signs of tainting. It is a curious fact that meat once submitted to the compressed air as above keeps indefinitely after the pressure is removed, care only being required to exclude the atmospheric dust capable of determining putrid phenomena. The only explanation which appears possible for this circumstance is that the compressed oxygen acts on the elementary organisms, in similar manner as upon animals and higher vegetables, and kills the animalculæ already formed within the apparatus, or the matter from which, by processes still unknown, they may be developed.

M. Bert placed some *mycoderma vini* on the surface of wine and applied the compression. The germs were killed instantly and fell to the bottom of the vessel, while the alcoholic properties of the liquid re-

mained unimpaired. Cherries, strawberries, and other fruits, and also wet bread, were equally well preserved. Milk presented an interesting peculiarity. While the germs to which lactic fermentation is ascribed were destroyed, coagulation was not retarded. An explanation of this is perhaps found in the fact already noted concerning the slightly acid reaction observed in meat. A solution of glucose, however, to which brewer's yeast had been added, produced alcohol despite the compressed gas, and urine containing a fragment of a filter impregnated with uric ferment produced ammonia. It appears in these cases that the oxygen could not act quickly enough to kill the ferment before the latter had affected the material.

The subject would certainly have remained incomplete if the fermentation term diastatic—that is to say, determined by soluble ferments—had been neglected. M. Bert has studied saliva and pancreatic juice, and others of like nature, and finds that all, without a single exception, retain their activity in the compressed oxygen. So that a valuable means of preservation of numerous important medicaments is found in simply enclosing them in a tube with the compressed gas.

From these facts, M. Bert suggests, some light may be thrown upon physiological problems now very obscure. It is a question, for example, whether accidents caused by the inoculation of diseased blood are due to the organisms contained therein, or to matter analogous to diastatic ferments. Both views are strongly defended; but it will be seen that the effect of compressed air will at once determine the matter, since the organisms, if existing, would be destroyed, while the diastatic ferments would remain unimpaired.

In the absence of the complete record of M. Bert's experiments, we are left in the dark as to the degree of pressure to which he subjects the articles to be preserved. This learned, it seems that we are at once provided with a means of keeping food, far easier to put in practice than any yet devised.

The hold of a ship, for instance, could be easily turned into airtight compartments and filled with meat, fruit, or other perishable material. These could be kept filled with compressed air by a simple air pump, at a uniform pressure, indicated by gauges. This pump, if the vessel were a steamer, could easily be run by the engine. Similarly, airtight cars could be made, and the atmosphere within kept at a given pressure. The discovery would thus enable Australian or Texas beef to be transported over the longest sea voyages, and the fruit of the tropics could be brought to the most distant markets. Similarly it allows of the preservation of the dead for any length of time. The body, instead of being put by the undertaker on ice, would simply be enclosed in an airtight case, into which air or oxygen would be pumped and then all openings hermetically sealed. The results of M. Bert's investigations are certainly of a very high degree of importance. If, as appears probable, they are found susceptible to the extended applications suggested, they will bring the exactions of extortionate ice companies to a sudden conclusion, for ice as a preservative will no longer find an employment.

Pure Iron.

The production of perfectly pure reduced iron is said to be effected by means of purified hydrogen. The method of obtaining hydrogen without the admixture of any foreign body has been described by M. Dumas and M. Bouissingault, but the oxide must also be purified from the water and sulphates which it contains. M. Crolas effects the latter in the following manner:

He takes protochloride of iron, and clears it of the sulphates it may contain by means of chloride of barium, and in order to get rid of the excess of the latter salt it is only necessary to cause it to crystallize, and then dissolve it in distilled water. Finally the precipitation is effected by means of the ammonia of commerce, which may now be obtained free from sulphur. By this process M. Crolas avoids the washing of the oxide, for the hydrochlorate of ammonia is easily driven off from the precipitate by heating the latter to redness. He thus obtains an oxide exempt from sulphur, which, when brought into contact with pure hydrogen yields perfectly divided iron, fulfilling all the required conditions. Another process consists in transforming protochloride of iron exempt from sulphur with oxide by means of calcination, in contact with the air. This operation, however, is both slow and difficult. The reduced iron prepared by these means is perfectly pure, and cannot give rise to the production of sulphureted hydrogen in the stomach. As a test for reduced iron, M. Crolas prefers oxalic acid, which may easily be procured pure, and which perfectly dissolves the reduced iron without giving rise to sulphureted hydrogen, which might be a cause of acting on the lead paper used in the testing. M. Fordos and M. Gelis have both proved that sulphuric acid, especially when concentrated, produces sulphurous acid when brought into contact with iron, and this in presence of nascent hydrogen is transformed into sulphureted hydrogen. In like manner hydrochloric acid should not be used as it almost always contains sulphurous acid.—*Iron Age.*

Heat Absorbed at High Temperatures, by Pig Iron, Cinder and Steel.

The following are the conclusions arrived at by Prof. Gruner in his late pamphlet on this subject:

1st. The gray pig irons do not carry with them from the furnace more than 280 to 285 calories, but at the top of the hearth often possess 300 to 310 calories.

2nd. The white pig irons contain, under the same conditions of production, 20 calories less.

3rd. The gray irons still retain at the point of solidification 244 to 245 calories; and immediately after solidification 221 to 222 calories.

4th. The white irons still retain at the point of solidification 226 to 235 calories; and directly after solidification 192 to 203 calories. This would give the latent heat of the white irons as 32 to 34 calories, while that of the gray irons is only 23 calories; a difference which arises from the fact that the impure gray irons remain soft and half disaggregated after their solidification, while the pure irons harden at once.

5th. The heat possessed by the cinders is about 16-10ths of that retained by the pig irons at the same temperature; *e. g.*, in the case of gray irons at the moment of tapping, the maximum is 500 calories, while in the case of the white irons it is 430.

6th. The latent heat of the cinders is about 50 calories.

7th. Bessemer steel gains by refining 30 calories above the heat possessed by the pig iron; but ordinary steel frequently possesses, when in a melted condition, but 300 calories.

8th. The quantities of heat in question agree very well with the temperatures of fusion determined by Pouillet; that is to say, the white irons melt between 1050° C. and 1100° C.

The gray siliceous irons melt at about 1200° C.

Ordinary steel melts at about 1350 to 1400° C.

And it may be added that the white iron possesses, when leaving the blast-furnace, a temperature of 1250° to 1300° C.

The gray irons 1350° to 1450° C.

Bessemer steel attains in the converter, at the period of refining, a temperature of at least 1500° C.—*Engineering and Mining Journal.*

The Columbia Conduit Company is delivering oil to a number of Pittsburgh refineries, and is making connection with more as fast as the pipes can be laid, almost all the refineries at this point having requested the connection to be made. The company is also laying pipes to different points in the oil region. Thus far its operations are not hindered by the railroad company.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

The Coombs Patent.

August 26, 1875.

Mr. Editor: In connection with the Coombs patent, reproduced in your issue of July 2nd, 1875, the following extract is of interest. It is taken from the Inaugural of Mr. Jabez Church, president of the British Association of Gas Managers, at their meeting for 1872; and may be found in the *London Journal of Gas-Lighting*, vol. xxi, page 532.

"It will be remembered that at our last meeting Mr. Somerville, in the course of his paper, "On the Cause and Prevention of Choked Ascension Pipes," stated that if ascension-pipes were cast double, or having a jacket surrounding them with a constant circulation of water or air from top to bottom, stopped pipes would be unknown.

"Now it appears that this idea had also occurred to one of our transatlantic brethren, who, it is said, had been impressed withthe notion some time previously, and by a curious coincidence had matured his plan sufficiently to be in a position to make an application for a patent on the very day that Mr. Somerville addressed us at Dublin. The patent, however, bears the subsequent date of November 38, 1871." S.

British Rivers.

The New York *Graphic* tells us that "the pollution of rivers is a topic that taxes the attention of British sanitarians to the utmost. The extent of the difficulty is certainly alarming. Nor is it caused solely by the sewage of cities and towns, bad as that is. The rivers are lined with manufactories of all sorts, chemical works, machine shops, and dye-houses, all of which pour their poisonous refuse into the rivers. And so great is the pollution of the water in some instances that when a light was applied to some of it dipped from the river at Bradford it actually burned. A man who accidentally tumbled into a river and swallowed a mouthful of water died of the effects. The effluvia that rises from the Clyde produces sickness in summer time, and the Mersey emits an unbearable stench. The water of the Bourne is yellow as ochre and thick as glue, and the horse that drinks it dies. And all the rivers are more or less affected in the same way, and the fish that survive in some of the streams are so unwholesome that they are unfit for food, if not dangerous. The government looks at the difficulty, but seems hardly to know what to do in the face of ancient usage. The question has a double aspect. The sanitary problem claims first attention. People must live. To poison the rivers is to destroy life by the wholesale. But this waste of all the sewage and other matters that are needed for fertilizing purposes is a point of great financial and social importance. Cheap fertilizers mean cheap bread. The wasted sewage of New York would give us millions of bushels of wheat and corn every year, and convert our wasting fields and half barren plains into gardens.

Lamp for Burning Nitric-Oxide Gas.

The brilliancy of the light produced by the combustion of nitric oxide gas, after mixture with a few drops of sulphide of carbon, has been known for some time, and its application to photographic purposes suggested; but it is not until recently that Messrs. Delachanal and Marmet have constructed an apparatus by which it can be made practically available.

They use a lamp made of a pint bottle, having two openings through the cork, and filled with fragments of some porous substance, as sponge, coke, or pumice, for the purpose of imbibing the sulphide of carbon. A tube, reaching within one-fourth of an inch of the bottom, passes through one opening in the cork, and a larger one through the other opening. This is about eight inches long, and may be of glass or metal, and is closely packed around with iron-scale. The object,

like that of the gauze in the safety lamp, is to prevent the return of the flame into the bottle, and its consequent explosion.

The nitric oxide gas is passed into the bottle through the first-mentioned tube, and the gaseous mixture is conducted by a rubber tube to a kind of Bunsen burner, the air-holes of which are closed, and which is furnished with a small conical valve to regulate the flow of gas. This burner is also filled with iron-scale. The nitric oxide gas is produced in the cold by Sainte-Claire Deville's method, by the action of a mixture of nitric and sulphuric acids upon metallic iron. With an apparatus of quite moderate dimensions, a dazzling flame, not less than ten inches in height, can be obtained, abundantly sufficient for the purposes of photographic work.

It has been estimated that the photographic power of the lamp is superior to that of magnesium, is twice as great as that of the oxyhydrogen light, and three times as great as that of the electric light. Furthermore, the flame is absolutely steady, and there is no danger of its sudden extinction, as with magnesium; and the eye can sustain its brilliance without being affected. Its cost is much less than that of either of the other lights.—*N. Y. Tribune.*

Lighting Street Lamps by Electricity.

The *American Artisan* describes a method now on trial at Providence of lighting lamps by this means. A small electrical coil is attached to each lamp, and this is connected to wires from a battery at the central office. The gas tap is opened and closed by compressed air, and the same action closes the circuit which is at once broken by the attraction of a magnet releasing the catch of a spring lever, when a spark passes, lighting the gas. The same lever which breaks contact also makes contact with the wire leading to the next lamp, where the process is repeated, and so on through all the lamps of the circuit. To extinguish the lamps the air pressure is reduced, and the taps closed, the circuit being previously broken at the battery. This brings the mechanism into position for lighting again. An indicator at the central office marks each break of the circuit, and consequently shows the lighting of each lamp or the place where anything is out of order. To judge from the drawings and description, the apparatus is somewhat complicated, but it is stated to work easily and regularly in practice. This method, it may be remembered, differs considerably from that described in a paper read before the Society in 1873, in which a small battery was affixed to each lamp, and the circuit was closed by pressure of the gas itself, raising the surface of the exciting liquid into contact with the elements. It should be added that the American method is the invention of Mr. Bean.—*Jour. Society of Arts.*

Illustrations of the Sun's Light, Heat, and Distance.

We will consider the sun's light. This we may compare with the oxyhydrogen light, which has but 1-146 of its intensity, or with the electric light, which is but one-third as intense. The heat by sun is also comparable. The estimates of its total heat are very variable, but that which it furnishes to the earth we are able to measure and arrive at exact results.

Sir John Herschel has found that the heat which falls upon one square mile, when the sun is in the zenith, is capable of melting in one hour 26,000 tons of ice. There are 50,000,000 square miles on the surface which the sun shines upon, and the heat which it receives would be sufficient to raise an ocean sixty-six miles deep in one year from the freezing to the boiling point. That received by the earth is but a small part of the light emitted, for 72,000 earths could be placed in the earth's orbit. The planets receive only the 227-millionth part of it. What, then, becomes of the rest? The stars, which are also suns, are giving out a large amount of heat, only a portion of which falls upon their planets. What becomes of all this heat which is radiated into space? That is a question which is yet unanswered.

But to return to the sun. The heat which is actually given out by one square yard is estimated to be equal to that evolved by six tons of coal burnt in one hour. The light and heat of the sun travel at the same rate, and probably the magnetic power also, yet it takes eight minutes for it to pass the space between us. If the sun gave out sound, and it undoubtedly does give out sound, it would take thirteen and one half years to bring it to us. But there is, strangely enough, a gap which it cannot pass. If those old heathen who prayed to the sun could have known how many, many years would have elapsed before their petitions would have been heard, if it were possible for the sound to have passed that gap, they might have desisted from their devotions. If a rod of metal were connected between the earth and sun, it could take 300 days for a sound to be transmitted from one to the other. There was a very nice illustration of the distance between us which had been given by an American whom we did not know, but which is based upon the rapidity with which a sensation is transmitted in the body. He said if a baby at its birth had an arm so long that it could touch the sun, that even if it lived three score years and ten, it would never know that its fingers were burnt.—*R. A. Proctor.*

The Universal Diffusion of Heat the End of all Energy.

Prof. Balfour Stewart recently delivered a very interesting lecture in Manchester, England, on the "Energies of Light and Heat." The lecturer explained the two great laws of thermo-dynamics, one of which, determining the quantity of mechanical energy necessary to produce one degree of heat, had been discovered by the eminent Mr. Joule, and the other, being the law according to which heat might be converted into work, the establishment of which law was greatly due to the labors of Sir William Thomson.

This latter law showed that no work could be obtained out of heat unless we had a fall of heat from a higher to a lower degree, just as we could get no work out of water unless it fell from a higher to a lower level. Upon this principle the uses of the boiler and condenser in a steam engine were explained, and in the work done by the globe, it was shown that the heat passed from a great boiler in the shape of the equator to condensers in the shape of the poles. While all work, as in the boring of a cannon or in friction, could be changed into heat, all heat could not be changed into work. According to this principle of the universe, the universal diffusion of heat would ultimately be the fate of all energy.

While the principle of the conservation of energy was quite true, there was also another principle equally true called the dissipation of energy. That was, as it were, the great communist of the world. It tended to distribute itself equally in such a way that no work could be got out of it, and would ultimately bring the visible universe to an end, at least, so far as available energy was concerned. Heat denoted two kinds of energy, namely, absorbed heat and radiant light and heat. Hot bodies parted with their heat to cold bodies by three processes—conduction, convection and radiation.

British View of the "Channel Tunnel."

A writer in *Iron* says: "Our insular position has always been our pride and boast, its advantages have been sung by poets, and we know to what happy incidents it is owing that "Britannia needs no bulwarks, no towers along the steep." We admit at once the commercial advantages which invariably accompany the establishment of quicker, surer, and more convenient modes of communication between one country and another, but at the same time it cannot be denied that those advantages in the present case would be purchased by a surrender of that insular position which has been a theme of jubilation to us and our forefathers for many years. We will suppose the railway completed, and a terminus built at Dover, into which trains laden with passengers emerge out of the dark tunnel at all hours of the night and day. Will the exterminus be turned into a fortress, and occupied constantly by a regiment of the guards? Will every train have to enter the station between two files of bayonets till it is ascertained that it is filled with peaceable civilians, and not with armed men? Such restrictions would be unendurable; and yet, in the absence of some such precaution what is to prevent half-a-dozen regiments of Zouaves from rolling into the station, taking military possession of it, and securing a safe outlet for reinforcements a hundred thousand strong, before any force could be assembled at all adequate to resist them? Once in possession, their numbers could be increased to any extent. They would have an assured base of operation, lying some fathoms below the keels of our channel squadron, absolutely beyond the reach of attack. Along that iron road, with a few days' grace at Dover, half the legions of France could be poured, and we should be suddenly called upon to oppose armies on the continental scale of magnitude with a force adjusted to the supposition that we should always be surrounded by 'streak of silver sea." So long as the invading force held the railway we should be, to all intents and purposes, connected with the Continent by a military road, safe against all raids and interruptions, and perfectly adequate to pour upon us as many troops a might be necessary for our subjugation. The sea might still be covered with our navies guarding our path on the "ocean wave," but that would avail us little when the Continental powers were in full possession of our back door."

Newspapers by Electricity.

The London correspondent of the *Liverpool Courier* writes to that journal: It has been hinted from time to time that one of our wealthy London journals has "under consideration" the practicability of printing its sheets in several of the great towns simultaneously, in order to secure a distribution of its copies as rapidly as the various local journals which are so fast depreciating the circulation and once paramount influence of their London contemporaries. How can this staggering fact be accomplished?

The leading journal had its attention drawn some weeks ago to an electric machine in operation at the London Stock Exchange, by which the fluctuating quotations are telegraphed to a number of city offices, where an instrument, composed of movable figures and dial-plate, is made to record changes from hour to hour. If an electric current can be made to manipulate movable figures, it was conceived that a system of mechanical type-setting might be carried on simultaneously in a number of distant places, the operation being directed from a central office in London; the news being there collected from all parts of the world, and that the "copy" might be put in type at several provincial offices simultaneously by operating on an electric keyboard, or a number of keyboards, controlled in the central office.

This idea, like so many other inventions, is not new. Mr. Mackay, of the Warrington *Guardian*, worked upon the same line of invention about eight years ago to my knowledge, and simultaneous type-setting by machinery was by him carried to a practicable issue, though he found that his invention did not result in profit. He worked a number of type-setting machines by operating on one keyboard, and proposed to set up newspaper columns for any number of papers by this simultaneous process, the only difference being that the various machines could not be placed in distant places. In other words, he did not connect them with electricity. The fact remains that he actually worked some ten or twelve machines on this principle of connected action which derived its directing power from one keyboard. There is no moral doubt that the some thing can be done on a wider scale by

electric agency. But if done, would the game be worth the candle? I know the *Times*, or rather the manager of its mechanical department, is putting the thing to a private test, in order to ascertain its mechanical practicabilities. If that can be made clear, the *Times* directors are not likely to be deterred by financial timidity from the next step in the unparalled adventure. What a world of journalistic development the prospect opens to prescient eyes!—*Paterson Press.*

Coal Mining on the Pacific Coast.

Coal mining on the Sound is growing into large proportions. It is an established fact that there is a coal-field on the Sound 100 miles long and 15 miles wide, containing coal adapted for all purposes. Seattle is the leading place at present where coal mines are in successful operation. The Seattle Coal and Transportation Company is taking out on Lake Washington 225 tons per day: by the 1st of August they expected to take out 300 tons, and by November 500 tons daily.

The Benton Coal Mining Company, on Cedar river, is shipping to Seattle 80 tons a day, and will be in a position to ship 150 tons by October. The Talbot Coal Company, located on Black river, is shipping 60 tons a day; the works are increasing so as to double the present production. The quantity taken out of these three mines is now 365 tons per day; by the 1st of January at farthest the production will be 1000 tons per day. The Seattle coal mine is opening and promises well. The Cedar river coal mine will be equal to any of the others opened. The demand at present exceeds the production. San Francisco is the principal market for the coal. The Seattle mines are from thirteen to seventeen miles from the town. The coal is brought down in barges to Seattle and shipped thence in vessels that carry from 1000 to 1500 tons, for San Francisco.

There are 267 men employed in the three mines now in operation. Miners get $1.25 per ton. First class miners make from $5 to $6 per day; the average is $4. Drivers get $3 per day; mechanics, carpenters and blacksmiths from $3 to $4, and common laborers $40 per month and board.—*N. Y. World.*

Casting Iron Pipes.

The great demand for water pipes has called forth the exercise of much ingenuity in their construction. In Glasgow and other places the moulding frames are filled with sand automatically, but the cores are still made by hand. M. Bertsch, of the Marquise Works, has studied the subject carefully, and has been enabled to supply the great pipes required for the bringing of the waters of the Dhuys to Paris in an unusually short period, and to execute a contract with the town of Lille at an unusually low rate. He employs two different kinds of apparatus—one for pipes of less than 6 inches diamerer, and the other for the larger.

In the case of the smaller pipes, the invention consists principally in the use of wooden moulds to shape the sand both for the exterior and interior of the pipe. The apparatus consists simply of a frame which slides on a horizontal frame, and a "lanterne" which contracts, so that it can be withdrawn without difficulty after the running, and which is applicable to the casting of all kinds of circular work.

For tubes exceeding six inches in diameter, M. Bertsch uses an apparatus which forms the mold within the frame, another which forms the core mechanically, and a peculiar oven for the drying. The mould is made by means of a central mandril. The moulding frame rests on a truck which is mounted on a platform arranged like a lift with counterpoises. The sand is consolidated by a series of blows repeated 24 times per minute; this is effected by very simple levers and gear worked by a six-horse engine. The rammer has gutters on its surface, which of course produce ribs in the sand, but at each blow the rammer turns slightly on its axis, when the salient parts of the rammer compress the ribs of sand, and *vice versa.*

When the moulds and cores are formed they are carried on rails to two annular furnaces heated by a hot-air calorifere in the centre. In one of these are placed the moulds, in the other the cores. The bottom of the oven is supplied with a table which revolves very slowly and facilitates the withdrawal of the moulds.—*Iron.*

An Improvement in House Heating.

Radiant heat, the sort required for perfect heat, obeys the same laws as light. By proper arrangements of reflectors and lenses, heat radiations can be massed into beams of parallel rays and sent anywhere with very little wasting. It is not until the radiations are arrested that they become manifest as heat; a fact put to practical use two thousand years ago when Archimedes burnt the fleet off Syracuse with mirrors. A stream of heat vibrations, intense enough to fuse gold, would pass through a tube of ice without affecting it, provided the air in the tube be sufficiently pure and dry.

There appears to be no good reason, therefore, why we should not warm our houses by the direct distribution of pure heat, and so gain all the benefits of an open fire in each room, with some of its disadvantages. Briefly described, the plan would involve first a central furnace, constructed, of course, with a view to the development of the greater amount of fuel; second, a system of tubes leading to the different rooms, terminated by radiators in each room; third, a system of reflectors to throw the heat of the furnace into the conducting tubes in beams of parallell rays, with other reflectors at the bends and angles of the tubes to direct the course of the radiations properly. The radiators in the rooms might be placed so that every portion of the room would be flooded with heat and rays, yet no part be heated beyond what would be enjoyable. As nothing would enter the rooms from the furnace save pure heat, the effect would be like that of a room warmed by direct sunshine.

The surplus heat of the furnace might be utilized in warming, say to 50° or 60° Fahr., and an abundant supply of fresh air led in from out-doors; a steady circulation being kept up, from the ventilating chamber, through the rooms, by the draft of the furnace. We should have then (theoretically) perfect heating combined with perfect ventilation; and at the same time the most economical combustion of our fuel. Possibly there may be mechanical difficulties to prevent the successful carrying out of a plan of house heating of this sort. We do not anticipate any, and the advantages it promises, on the score of health, comfort and economy, certainly justify its trial by any one possessing the requisite means. The plan could be easily tested in the laboratory of any institution having a few lenses and reflectors.—*Scientific American.*

Car Ventilation.

A party of railroad and scientific men made a special trip between Boston and Springfield, Mass., recently, for the purpose of testing a new mode of car ventilation. The arrangement is an application of the fan system.

Upon the centre of the axletree of one of the trucks is securely fastened a driving pulley 22½ inches in diameter; from the driving pulley runs a small triangular belt, 1½ inches wide, over another pulley 4½ inches in diameter, attached to a fan made of galvanized sheet-iron upon a steel shaft. This constitutes the mechanical adjustment for putting in motion the required supply of air. Ordinary car wheels are 33 inches in diameter of 8.64 feet in circumference; hence in passing over a mile of track the wheels make 611 revolutions, and the size of the pulleys being as one to five, the fan revolves 3,055 times; that is, when the train moves at, say, one-third of a mile per minute, or 20 miles per hour, the fan revolves at about 1000 per minute, or 1,500 at 30 miles per hour. To conduct the air which has been put in motion by the centrifugal force of the fan, to the top of the car, and to distribute it evenly, the fan is surrounded by an elongated sheathing of wood, which may be seen under the car, and which is continued by a tin conducting-tube through the closet to the distributing pipes, which in turn emit the air into the car. This sheathing being air-tight, the fan is, so to speak, hermetically sealed, and none of the outside air can get to it or feed it except that which passes through the air-chamber.

Now, since all the air which finds its way into the air-chamber must pass through the fine screens, which are inserted in place of the window glass, the dust and cinders must be left outside the car. The experiment was very satisfactory. A small quantity of cologne was placed in the air-chamber, and the odor was immediately perceived in every part of the car. The same effect was observed when smoke was made in the air-chamber, which found its way at once in a uniform diffusion in the car. The air was then shut off, and the car was filled with a dense cloud of smoke; upon admitting air the smoke was principally removed in three minutes, and in six minutes the car was entirely clear. Notwithstanding the large amount of air taken into the car, there was no dust from the roadbed nor cinders from the engine.—*Sanitarian.*

Lighting of Railway Carriages by Gas.

The Central Swiss Company has recently made some experiments in lighting railway carriages by gas, the results of which are highly satisfactory. The gas is enclosed in a special receptacle for each carriage. The gas which burns best is that obtained from the refuse of oil, the volume for an equal light being only one-fourth that of coal gas. The inventor is Herr Hirzel, of Zurich, a Leipzic professor. The process consists in forcing by the aid of a self-acting apparatus the refuse of fat substances, or of petroleum, etc., into retorts, which are heated in furnaces in the same manner as retorts for coal-gas. Over the furnace is a hydraulic main for preventing the gas evolved from returning to the retorts. The gas next passes into a purifier, and lastly into a gasometer, the dimensions of which are much smaller in proportion than in those for coal gas. The counters, regulation of pressure, etc., are the same as in ordinary gas works. A flame of an intensity equal to eight flames from carcel oil costs about three halfpence per hour, including the cost of works, interest on capital, and labor. With 220 lbs. of refuse, from 2,400 to 2,600 cubic feet of gas are produced; and a flame equal to 10 carcel flames consumes about a cubic foot per hour. The gas thus obtained is compressed by means of a pump to 10 or 12 atmospheres in reservoirs fixed under the carriages, whence it is led by pipes to the burners, after having passed through a pressure regulator.—*Jour. Society of Arts.*

Confessions of a Chemist.

Dr. Crum Brown, president of the chemical section of the British Association at Belfast, says: "One thing we can distinctly see—we are struggling towards a theory of chemistry. Such a theory we do not possess. What we are sometimes pleased to dignify with that name is a collection of generalisations of various degrees of imperfection. We cannot attain to a real theory of chemistry until we are able to connect the science by some hypothesis with the general theory of dynamics. No attempt of this kind has hitherto been made, and it is difficult to see how any such attempt can be made until we know something in reference to the absolute size, mass, and shape of molecules and of atoms, the position of the atoms in

☞ *For other reading matter see page 90.*

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THURSDAY, SEPTEMBER 2, 1875.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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ANNOUNCEMENT.

For some months past the undersigned has consented to remain in editorial charge of this Journal but until the publishers could be suited as to a new incumbent of the editorial chair. Learning that this is now accomplished, he now takes the leave of the editorship, with thanks to those of the gas profession who have kindly appreciated his efforts to promote the scientific study of gas; and with whom he hopes to remain in cordial professional relations, as a gas-chemist.

HENRY WURTZ.

MR. SMEDBERG ON AMMONIA.

In the valuable communication in this issue, from that thorough scientific and practical gas-engineer, Mr. Smedberg of California, he makes some curious suggestions that we want to expatiate on slightly; the matter being a hobby of our own, referred to more than once in these columns. This is the saving of the *ammonia* from the gas. It will not be expected that we should discuss Mr. Smedberg's main topic, the Pelouze and Audouin Condenser, as our knowledge of it is altogether at second hand, and therefore but mere matter of opinion at best. This we say purposely, for the reason that thus certain inquiries that have reached us may possibly be disposed of, in the way that seems to us preferable, under the circumstances.

By the way, speaking of inquiries—and as we are, moreover, on the subject of ammonia, and as the question is one that may interest others besides the actual inquirer in the case—we shall take the opportunity here to reply to a chemical question propounded involving ammonia. The question we quote—"What absorber of ammonia enters into the composition of the 'iron-mixture' used at the Harlem Gas-Works?" This of course has reference to the report of the Editor upon the St. John apparatus, in which it appeared that though the gas left in the condensers and scrubbers with near a grain and a-half of ammonia per cubic foot, it left the purifiers with only ·0468 grain, or less than one-twentieth of a grain per foot.

When the iron-mixture of St. John and Cartwright (that used at Harlem, as well as at the New York Gas Works and others) is *first put in*, fresh made, into the purifiers, it can have but little capacity to absorb ammonia; but by use it must very rapidly acquire a very great and continually increasing capacity to take up this impurity. When exposed to the air, during the revivification, there is always a production of more or less of sulphuric acid, by the oxidation of sulphide of iron present, and one of the products is sulphate of iron, whose power to absorb ammonia all are aware of. The composition becomes rapidly charged with sulphate of ammonia by use, like all iron compositions. In Europe sulphate of ammonia has been obtained commercially in this way, it is stated.

To recur, after this digression; we must certainly commend the general views of Mr. Smedberg on ammonia-saving, as highly worthy to be pondered. It is a subject which we think has been much neglected by the profession in America; and we wish here to add that there recently reached our hands, sent, as we understood, by Mr. S. a *sample* of strong liquid ammonia. We understood (orally, there being no written specification with the bottle) that this was ammonia saved by Mr. Smedberg in his process. All we can say is that the sample was *very pure* and fine ammonia, free even from the *aniline* compounds and similar impurities that are liable to occur in ammonia from gas liquors. Possibly these remarks may elicit some further information from Mr. S. on this interesting subject. If we understand his remarks he means to convey what we can readily believe, that for the production from the gas of a strong and pure liquid ammonia, it is not necessary to go through the round-about operation of making it first into *sulphate*. We trust to learn more from him.

His reference to promoting "the sale of liquid ammonia, *on tap*" in the grocery stores throughout the land is not, we must say, clear to us. What *demand* would be, in this way, met? We shall be much pleased to hear Mr. S. on the subject.

WATER-GAS.

Since two recent events, one of which was referred to in our last, the patient discussion of water-gas last June by the British Gas Managers in conclave assembled, and the other—also to be found in our last issue—being the call of Mr. Somerville, as one having authority in the profession, upon inventors to improve the manufacture of water-gas, we feel encouraged to think that this at least is a topic no longer to be rather insinuated than spoken "right out in meeting"—a light no longer to be hidden under a bushel.

It seems as if there is certainly going to be a fair chance to test the whole question, under a great many varying circumstances. We are told, though of our own knowledge we know not, that at Poughkeepsie the National Coal Gas Company are now making water-gas, with how much success we cannot say. We have already referred to the extensive arrangements making in this city, in 41st Street, to bring into operation water-gas works on the Tessie du Motay system on a scale of half-a-million feet per day; and the latest advices we have are through our valued exchange, the *Engineering and Mining Journal*, which had recently an account of operations, apparently much beyond the experimental stage, in progress at Utica. We shall quote a few sentences:

"Mr. Lowe's process consists in producing, from anthracite and the decomposition of steam, a gas of very high heating power, and then enriching this by means of crude petroleum when the gas is to be used for illuminating purposes. The anthracite is charged in a small cupola of, say, 3½ feet diameter, the bed of coal being kept from 3 to 4 feet deep. When fairly ignited, the base is closed, and superheated steam is admitted through tuyeres a short distance above the grate bars; the steam in contact with the burning coal is decomposed, and the gas produced is a mixture of hydrogen and carbonic oxide. The cost at which this excellent heating gas is produced is very small, indeed, and its application in metallurgical processes and for domestic use offers many important advantages."

Doubtless some of the profession would like to hear of what is going on in this and similar quarters, if we may judge from the remark of Mr. Somerville; and the writer will make all reasonable effort to become and to keep informed about these things.

GAS-ENGINES.

There seems just about this time, on the other side of the Atlantic at least, to be something of a stir in the matter of gas engines. It is a little strange that this thing has all died out among us. It must be owing to the comparatively high cost of our gas. Now that the era of cheap water-gas is coming, when we ought to have gas, for heating at least at a dollar per thousand, in-

ventors must pluck up their courage, and we must see what Yankees can do in this direction. In this issue will be found an article from over the water, on the subject. In the discussions that are in progress in Europe upon this topic it is asserted that instead of—as with steam—having the piston rushing to and fro whilst no useful duty is doing, it is at perfect rest, and there is, consequently, economy both in fuel and wear and tear, as compared with steam. There are other advantages in the power of starting at a moment's notice, and starting, too, at full power; in the fact that while the engine is standing no fuel at all is burned; in the very trifling attendance required, very much less than with steam; there is no trouble with coal and ashes, nor in many cases is any water consumed. The engine not having any boiler no explosion can take place, and thus insurances are not affected by its use, or are only very rarely affected. Taking all into consideration, the commercial side of the question is entirely in favor of the gas engine in the matter of economy of fuel. Taking fuel lost in raising steam and while a steam-engine is standing, and the cost while running, in Great Britain, gas engines have sometimes saved upwards of 10s. per week in fuel alone where they have replaced small steam-engines, besides the saving in attendance, which is often considerably more. The gas engine also realised a considerably greater percentage of the theoretic efficiency of the fuel than the best steam-engines.

WHAT IS COAL?

This is a question which should certainly be deemed discussable in these columns. Our readers are already aware of our own view on this head, which is simply to the effect that, as a precise and scientific term and definition, *coal* has no meaning at all, and no use whatever! In our valued contemporary, the London *Mining Journal*, there appeared lately a review of a new edition of Percy's Metallurgy, which furnishes so good an illustration of the Cimmerian darkness in which this subject is involved, that we shall quote it, especially as it is in itself quite a literary curiosity. The reviewer, referring to the chapter on Fuel, says—"The old dispute with reference to the Torbanehill coal is first referred to, in which the judge pointed out that scientific opinions were worthless because so conflicting, and that the question for the jury was whether it was coal in the language of those persons who deal and treat with that matter, and in the ordinary language of Scotland? The jury determined that it was coal, and this view all the scientific opinions in the world will not alter. To attempt to bind men of business by the comicalities of men of science is simply absurd, although scientific accuracy cannot be too strongly urged among men of science themselves, and in the lecture room, provided it be well understood that the scientific and the popular, or commercial acceptation of a word is not necessarily the same. This is especially the case with regard to such matters as coal and other materials, the composition of which is not always identical. It is less than a year since there was noticed in the *Mining Journal* an educational book, the author of which declared, not that the Torbanehill coal is not coal, but that coal is not a mineral, whilst Dr. Percy now states that perhaps a near approach to a definition would be—Coal is a solid, stratified, mineral, combustible substance, varying in color from dark brown to black, opaque except in extremely thin slices, brittle, not fusible without decomposition, not sensibly soluble in ether, benzole, chloroform, or oil of turpentine, not containing sufficient earthy matter to render it incapable of being applied with advantage as a source of heat, either in ordinary fireplaces or in furnaces. Most persons will agree with the doctor that this may be a near approach to a definition of coal, but perhaps fewer will consult it during a negotiation for the leasing of a coal property. The origin and formation of coal is described, and in the article on the microscopic examination of coal, it is shown that what Dr. Bennett mentioned as conclusive evidence that the Torbanehill coal was not coal, is shown by Dr. Dawson to be a strong argument that it is coal. It is pointed out that the geological age of coal is not ascertainable from physical and chemical characters."

"Comicalities of men of science" is good. We cannot concur with the writer in his implication that men of science are not to be consulted upon such questions—in a court of law for example—but that only "business" experts are to have their say on the question; and we do not believe that the world will ever be got to believe that the testimony of scientific experts—always supposing them to be really such, and not mere *popular* scientists; and moreover to be possessed of conscience as well as science—is not upon the whole more reliable upon mooted questions, than the empirical or individual notions or fantasies of so-called "practical men," part of whose pride is that there is no possible subject upon which they do not individually differ *tot cælo* from each other and from the rest of mankind. This is in fact inevitable, as the "practical" expert, in his specialty is nothing, unless possessed of special experience and skill in advance of all the world.

To return to our subject. It is certainly a most curious fact that this common word *coal* has been so universally and familiarly used to denote materials that vary among each other in almost every conceivable property and characteristic—save one, that of combustibility—that it is really, for all scientific purposes, useless; and in due time—and no very far time—must disappear altogether from scientific discussions, where *precision* is needed.

Even taking Dr. Percy's guarded definition above—which, it will be seen, excludes many substances that have passed for coal, such as our American albertite and grahamite—it is still not difficult to suggest minerals, occurring in abundance, which are covered by it, and which yet are not coal, in a scientific sense. *Jet* is one such material. The James River carbonite is another. The Australian hartleyite (which has been mistakenly called "wollongongite") is another.

As we must cut this short, for the present; let us only add, that it seems best to have it understood that the man of science does not, either theoretically or practically, recognize any such term as coal, as having any general scientific application or generic significance. Had Dr. Percy recognized this inevitable difficulty and acknowledged the indefinability of the word, as developed by modern science, he would have escaped the public ridicule conveyed in the above quotation which must be felt, more or less, by sympathy, by all men of science, and those who respect science, throughout the world.

THE AMERICAN INSTITUTE FAIR.

The coming exhibition of the American Institute Fair gives promise of being one of the largest and most interesting exhibitions of the various domestic industries ever held since the formation of the society—and no pains, on the part of the managers and others connected with it, will be spared to make the affair a complete success.

For the past week workmen have been busily engaged in arranging spaces on the floor for the different specimens of mechanical ingenuity which will be there exhibited.

In a few days the Rink will be thrown open for the reception of goods. Intending exhibitors should not delay in making responses, and run the risk of losing the space allotted to them. Therefore, be in time with your goods, as a sufficiently long notice has been given.

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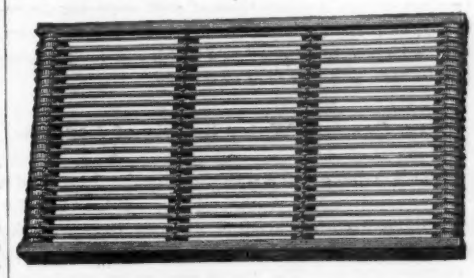

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SOMETHING NEW.

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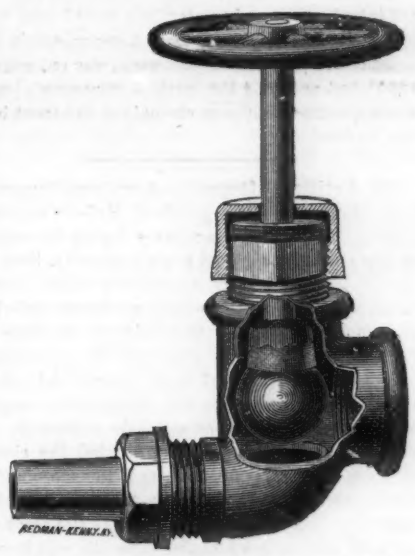

This valve is made of malleable iron, and is specially adapted to encounter the heat of burning buildings, in which the ordinary meter cock (made of brass) will crumble or melt. It is opened or shut with ease, by sliding the stem up or down, the latter being held where desired by the friction of the packing. It is perfectly tight, and is not so liable to get out of order as the meter cock: its cost being about the same.

The great advantage of this valve is, that in case of fire—when the gas cannot be shut off by hand, the heat will automatically close the valve, and thereby stop the flow of gas. The certainty of its action in this way will be at once apparent when it is observed that the valve proper is a round iron ball, attached with a soft solder composition (melting at 250°) to the end of the stem, and held directly over the seat. The heat of the fire, melting the solder, releases the ball, which drops into the seat, and shuts off the gas.

Peference is made, by permission, to the following gentlemen, well-known to the gas fraternity—H. Q. Hawley, President Peoples Gas-Light Company, Albany, N. Y.; Isaac Battin, Engineer Albany Gas-Light Company, Albany, N. Y.; F. A. Sabbaton, Engineer Gas-Light Company, Troy, N. Y.; C. House, Proprietor Union Gas Works, Lansingburgh and Waterford.

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the molecule, and the nature of the forces acting upon them. Whence can we look for such knowledge? The phenomena of gaseous diffusion, of gaseous friction, and of the propagation of heat through gases have already given us an approximation to the size and mass of the molecules of gases. It is not unreasonable to suppose that a comparative study of the specific heat of gases and vapors may lead to some approximate knowledge as to the shapes of their molecules, and a comparison of such approximate results, with the chemical constitution of the substances, may lead to a hypothesis which will lay the foundation of a real theory of chemistry."

The Gas and Water Supply of London.

The London gas and water companies have had a good time for many years, and they will fight hard for a continuance of it; but the example of places like Manchester, where the community manufactures its own gas and provides for its own water supply, and puts money in its pocket thereby, will have its effect, and in the long run the companies must yield. The gas people are already in the grasp of Parliament—a grasp which is more likely to be tightened than relaxed in the future—and the arrangement by which the water rate rises with the rise of the assessment will be a continual spur in the sides of the ratepayers and a never-failing weapon in the hands of parish demagogues. These companies are not wise in their generation in insisting on their doubtful right to charge upon a scale which is from 15 to 20 per cent. above the poor and other rates. The democracy is too powerful, and the jealousy felt towards rich companies too strong and general, to make it prudent in their officials to go to the full length of their legal right even, much less to act towards defaulters in the high-handed and harsh manner they are too apt to fall into, or to supply water in a turbid and imperfectly filtered condition. Lord Camperdown's interpellation on the subject, last week, was put aside cleverly; but not only the part it concerned, but the whole question will come strongly in the front before ong.—*Iron.*

An Artificial Geyser.—A curious phenomenon is exciting some of the people of McLean county, in Illinois. While some men were boring for water to supply a well for a school house, recently, they were startled by a sudden and violent commotion beneath them, and hastily getting their machinery out of the way, they were treated to a volcanic eruption on a small scale. Out of the hole made by the workmen, there issued a stream of sand, gravel and pebbles, propelled with such force that it rose to the height of from 50 to 100 feet, as variously estimated. The strong wind that was blowing carried the cloud of sand a considerable distance, and in such quantities was it expelled from the earth that the ground was covered with it for a distance of fully 100 yards from the well. On the gas escaping from the well it caught fire. The flames shot up to a great height, and it was with the greatest difficulty that the neighbors who had assembled, succeeded in saving the school-house and extinguishing the flames. On Monday last there was no active eruption, but a loud and continuous rumbling was heard in the earth, while the sand and other material would "boil" up in the well nearly to the surface, and then sink back. The action very much resembled that in a volcano without the melted lava.—*N. Y. World.*

Nickel Plated Screws are coming rapidly into employment for upholsterers' and builders' use, and also in the manufacture of cars, omnibuses, etc. They cost somewhat more than silver-plated screws, but they retain their brightness very much longer, as they do not tarnish under the action of sulphurous gases like silver. The slight addition to their cost weighs very little against this great advantage. In house-joinery, an English paper states that there is a steady increase of the demand for screws of this kind.—*Am. Artisan.*

Gas Stocks.

Quotations by W. B. Scott & Co., Brokers,
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[September 2, 1875.

☞ All communications will receive particular attention

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Manhattan	50	295	300
Metropolitan	100	155	165
" Scrip	..	106	...
Mutual	100	103½	106
New York	100	154	...
Westchester	50	100	105
Gas Co.'s of Brooklyn.			
Brooklyn	25	245	250
Citizens	20	...	152½
" Scrip	...	101½	...
Peoples	10	96	100
Bonds	...	98	...
" Scrip	...	102½	...
Metropolitan	100	100	102
Nassau	25	121½	...
Williamsburgh	50	142	...
" Scrip	...	102	...
Out of Town Gas Companies.			
Buffalo Mutual, N. Y.	100	50	50
Baltimore, Md.	100	190	...
Citizens, Newark	...	...	55
Derby of Connecticut	100	...	80
East Boston, Mass	25	112	115
Hannibal, Mo.	100	90	...
Hartford, Conn	25	41	43
Hempstead, L I.	100	...	100
Jersey City	...	160	...
Jamaica, L. I.	100	...	100
Lewistown, Maine	100	...	80
Peoples of Jersey City	...	130	65
Peoples of Albany	100	45	...
Peoples of Baltimore	25	108	...
Rochester, N. Y.	100	50	...
Fort Wayne, Ind.	100	...	105
Woonsocket, R. I.	100	100	...

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British Province Coals.			
Pictou			2 25
Block House—At Mines, $1.87, Gold			0 00
Caledonia—At Mines, $1.75, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			2 00
Lingan—At Mines, $1.75, Gold			0 00
Sydney—Old Mine			3 00
" Reserve, $1.75, Gold Mine			2 25
" International			— —
(Duty, 75 cents per ton, gold. Freight to New York $2 25 currency. Cost of above coals delivered in New York, $5 25 @ $6 00, currency.)			
Pennsylvania Coals.			
Penn Gas Coal—At Amooy	$6 50	@	0 00
Westmoreland—At Amboy	6 50	@	0 00
(In New York both the above coals $6 50)			
Shafton	6 50	@	0 00
Youghiogheny	6 50	@	0 00
West Virginia Coals.			
Murphy Run	$6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —
American Cannel Coals.			
Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25
Asphalts.			
Albertite of New Brunswick	$— 00	@	— 00
Ritchie Mineral of West Virginia	18 00	at Balt'e.	
Trinidad Bitumen	— —	@	14 05

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Advertisers Index.

☞ In looking for advertisements, see figures 1 to 12, within brackets, at head of advertisement pages.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston.... 11
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa. 8
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa. 10
Cast Iron Gas and Water Pipe—Jno. McNeal & Sons, Burlington, N. J. 8
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa. 2
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass. 3
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa. 9
Gas Purification—St. John and Cartwright 5
Gas Meters, etc.—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa. 10
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa. 11
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry st., Philadelphia, Pa. 11
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway 7
Gasholders, Etc.—Delly & Fowler, 39 Laurel st., Phila., Pa. 4
Gas Screen—James P. Mahon, Boston, Mass. 5
Gas Engineer—Henry Cartwright, Phil. Pa. 4
Lime Hurdles.—Manhattan Lime Hurdle Co., Geo. W. Day, Treas., No. 3 Railroad Square, Haverhill, Mass. 2
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa. 8
National Tube Works Co., 78 William St., N. Y. 7
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y. 4
Patent Gas Exhauster—Smith & Sayre, 95 Liberty sttreet 4
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa. 1
Petroleum Gas—J. D. Patton, Treverton, Pa. 4
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y. 3

GAS COALS.

Cannelton Coal Co. of West Virginia—J. Tatnall Lea, 325 Chestnut street, Phila, Pa. 3
Despard Coal Co.—Parmelee & Bros., Agents, 32 Pine st., New York 7
Gas Coals—Bird, Perkins & Job, 27 South st., N. Y. 7
Monongahela Gas Coal—56 Exchange Place, Baltimore, Md. 6
New York and Cleveland Gas Coal Company—384 Penn Avenue, Pittsburgh, Pa. 6
Ohio Gas Cannel—G. Merryweather, Pine cor. Wm. sts.
Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y. 6
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y. 5
The Newburg Orrel Coal Co.—Chas. W. Hays, Agent in New York, Trinity Building, 111 B'way, Room 7 6
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md. 6
Westmoreland Coal Co.—230 South 3rd Street, Phil. Pa. 7
Youghiogheny Coal—Perkins & Job, 27 South St N. Y. 7

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y., P. O. Box 2348.
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md.
Continental Works—T. F. Rowland, Greenpoint 6
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son. 5
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa. 4
Mill Street Foundry.—Geo. Stacey & Co., Cincinnati, O. 5
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa. 6
Oregon Iron Foundry—Herring & Floyd, 740 Greenwich street, N. Y. 10
Pascal Iron Works—Morris, Taskar & Co., Philadelphia. 12
Providence Steam and Gas Pipe Co., Providence, R. I.—H. A. Branch, Agent 3

WATER METERS, PUMPS, ETC.

Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y. 10
Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940 River street, Troy, N. Y. 6
Water Pipes, etc.—S. Fulton & Co., 412 Walnut st., Phila. 7

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y. 8
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo.
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y. 8
Philadelphia Fire Brick Works, Vine and 23d sts., Phila. 8

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa. 1
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal. 9

MISCELLANEOUS.

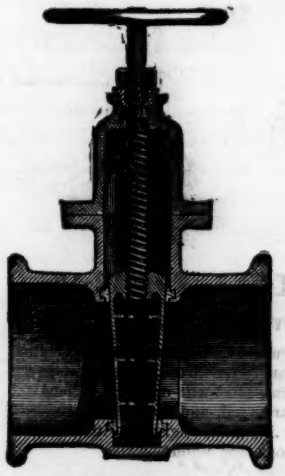
Analysis and Testing of Gas Coals—Prof. Henry Wurtz, 12 Hudson Torrace, Hoboken, N. J. 10
Architect and General Gas Engineer—William Farmer, 111 Broadway Room 95, N. Y. 5
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y. 7
Cements—S. L. Merchant & Company, 76 South st., N. Y.
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind. 2
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York 1
Gas Engineer—B. E. Cholliar, 914 Olive St., St. Louis, Mo.
Gas-Light Company of America, 63 and 64 Drexel Building, New York 3
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y.
Massachusetts Institute of Technology—Samuel Kneeland Boston, Mass.
National Coal Gas Company—H. P. Allen, 4 Warren street New York.
School of Mines, Columbia College
Screening Shovels—Herring & ...
New York.
Scientific and Practica...
Henry Wurtz, 12 Hud...
Screening Shovels—G. ...
Springfield Gas Machine...
Slade's Automatic Fire Governor...
Yonkers, N. Y.

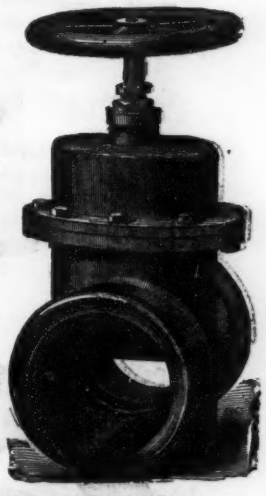
CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.





These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

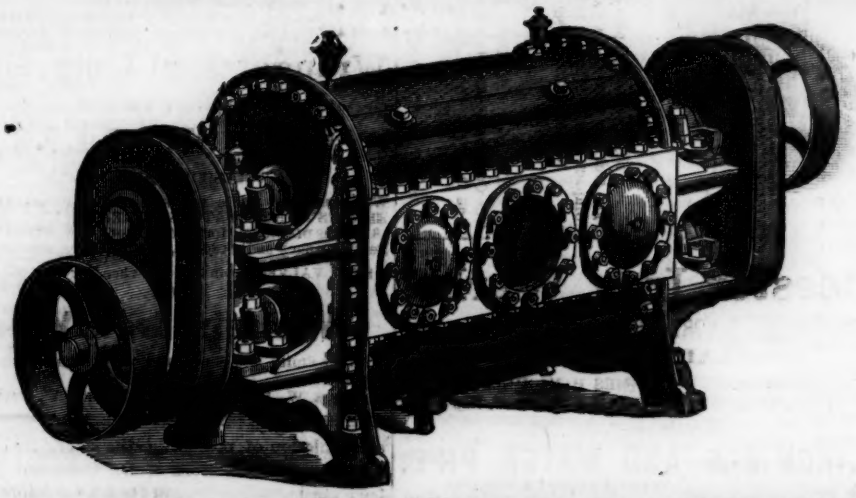
We refer to the following named Gas-Light Companies among the many that have used these Valves:

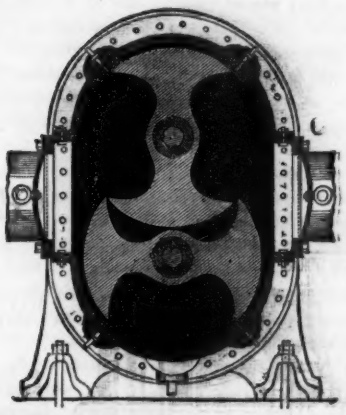
BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.

357-tf

PATENT IMPROVED GAS EXHAUSTER.





P. H. & F. M. ROOTS, PATENTEES AND MANUFACTURERS, CONNERSVILLE, IND.

S. S. TOWNSEND, GENERAL AGENT, 31 LIBERTY STREET, NEW YORK.

The following are some of the advantages we claim for this Exhauster over all others:

FIRST.—It is simpler in its mechanical construction than any other Exhauster in use.

SECOND.—The internal parts consist of only two revolvers, each cast entire in one piece, without a single screw, bolt, nut, washer, key, or other part to get loose on the inside and stop or break the machine. The internal operating parts, therefore, can not get out order, and hence require no care or attention.

THIRD.—Every part of the machine requiring care or attention, as the journals, gearing, etc., is external, easily observed and attended to. All changes, adjustments, and repairs are made from the outside. The journal bearings, if necessary, can be renewed in a few minutes.

FOURTH.—The internal operating parts are practically gas-tight, but are not in actual contact, hence there is no internal friction or crosce... The machine is therefore operated with less power than any other.

what Dr. Bennett... are built in the most complete and substantial manner, with steel shafts and improved journal bearings, and their dence that the Torbar... without limit.

shown by Dr. Dawson to ... of any required capacity, large or small, adapted to any kind of works or place.

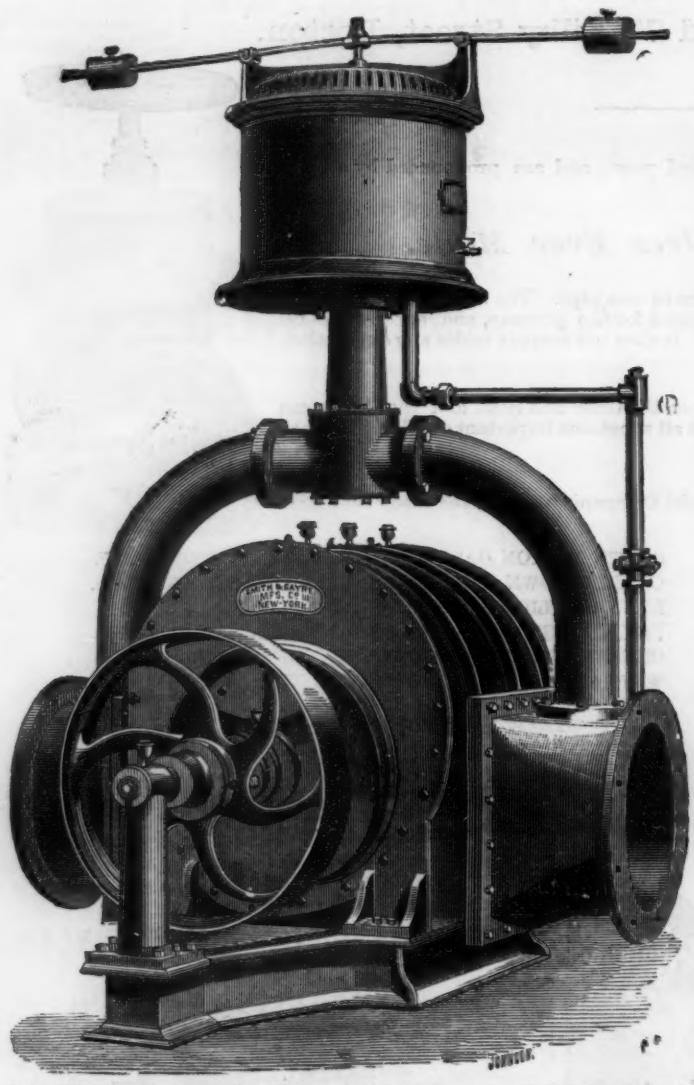
that it is coal. It is point... ustrated Catalogue, giving all particulars as to capacity, speed, power required, dimensions, and price of each size, ical age of coal is not... cal and che...erences to parties using them.

P. H. & F. M. ROOTS.

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan.

The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola and 33 per cent fuel. Address

G. G. PORTER, President.
JAMES M. SAYRE, Treasurer.
CHARLES W. ISBELL, Secretary.

OFFICE, 96 LIBERTY STREET, New York.

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OFFICE—NO. 5 NORTH SEVENTH STREET,

PHILADELPHIA.

DAVID S. BROWN, Pres't. JAMES P. MICHELLON. Sec'y.
BENJAMIN CHEW, Treas. WILLIAM SEXTON, Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves, water or Gas.

Fire Hydrants,

GAS HOLDERS.

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

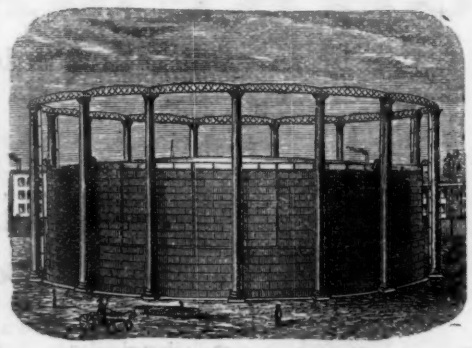
916 Market Street, St. Louis, Mo.

T. F. ROWLAND,

Continental Works,

GREENPOINT, BROOKLYN, N. Y.

ENGINEER, AND MANUFACTURERS OF



GAS-HOLDERS

OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Philadelphia Office, People's Bank Building, 435 and 437 Chestnut Sireet.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses Retorts and all castings required for setting them in the latest and most improve model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varyin from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS ERNORS or REGULATORS, STREET MAINS, from 1¼ 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SIEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

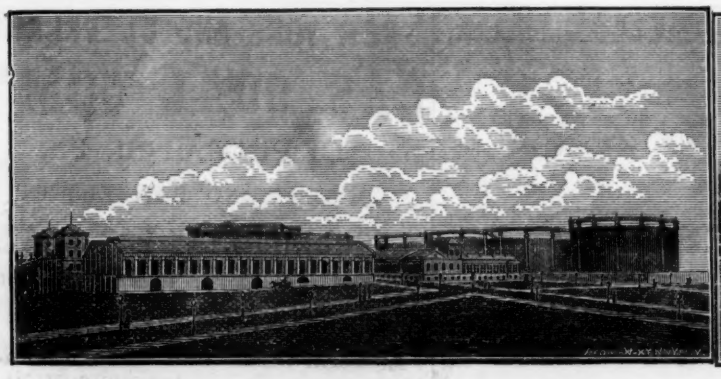
Wrought Iron Work.

All the Smith and Sheet Iron work required in and abou Gas Works. 226-tf

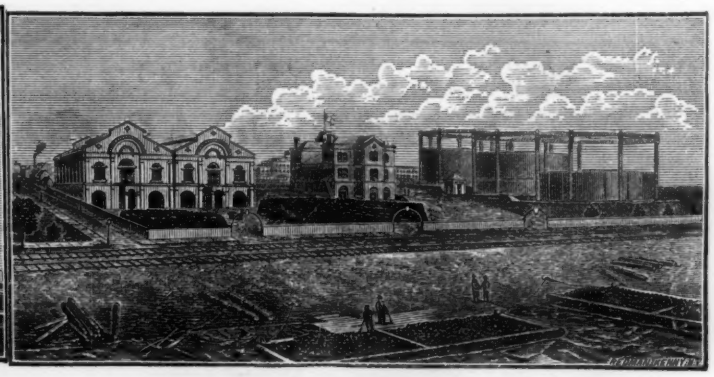
JESSE W. STARR. JESSE W. STARR, JR.

Does Paris Green Poison Potatoes?

The questi n has been mooted, "Is the use of Paris green in the extermination of the potato bug, dangerous to man or vegetables?" We are favored by the kindness of Mr. Chelius, the well known German druggist of this city, with a copy of the *Druggists' Circular and Chemical Gazette*, which answers a question by a correspondent who asks whether the Paris green will be absorbed by the potato in sufficient quantities to be poisonous to those who eat it, and also whether it will not kill or injure the potato or vine, and prove injurious to succeeding crops by the accumulation of poison in the soil? Its opinion is based upon observations of Dr. Davy and Mr. Horsley. Arsenic—the basis of Paris green—not being an essential constituent of plants, is not so readily absorbed as the elements that are necessary to their proper growth and perfection, as potash, silica, lime, etc. Vegetables grown on soils manured with superphosphates containing arsenic, acquire a notable impregnation of that element. A young pea-plant watered by Dr. Davy daily for three or four days with an aqueous solution of arsenious acid, and the operation then discontinued, although it grew to perfect maturity, showed in leaf, stalk and pod the presence of arsenic. Tests on other vegetables showed that although the growth of the plant was not apparently affected by the use of arsenic, the plants absorbed the same in appreciable quantities, and hence, of course, would be dangerous for food. Mr. Chelius adds his opinion that the use of Paris green on pot to plants will be so lasting in its effects, as to be dangerous to those who plough the land the following year.—*Paterson Press.*



CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.



LACLEDE GAS WORKS, ERECTED 1873.—WM. FARMER, ENG

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

Professor SILLIMAN, New Haven, Conn.
GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL, N. Y.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal.

P.P. DEILY, 1842. J. FOWLER. 1875.

DEILY & FOWLER,

39 LAUREL STREET, PHILADELPHIA, PA.,

Builders of Gas Works.

MANUFACTURERS OF

GAS-HOLDERS,

Single and Telescopic.

WROUGHT IRON ROOF FRAMES,
COAL WAGONS,
COKE BARROWS,

AND ALL

Wrought Iron Work

CONNECTED WITH GAS WORKS.

☞ Particular attention paid to Extensions and Repairs.

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

Office & Factory 52 East Monument St.,

BALTIMORE, MD.

DUFFEE'S IMPROVED

GAS SCREEN,

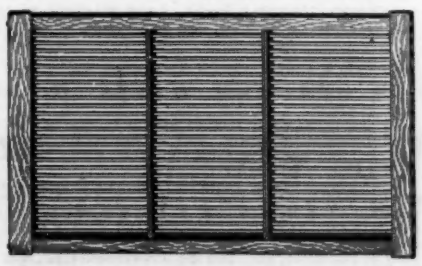
OFFICE 19 *TREMONT ROW, ROOM* 5,

BOSTON, MASS.

JAMES P. MAHAN, Treasurer.

Manufactory at Haverhill, Mass.

E. DUFFEE, Agent,
Formerly with AMERICAN GAS SCREEN CO.,
Haverhill, Mass.



The Screen is made with an ash or oak frame, perforated with ROUND RATTANS, turned and reeved through, drawing the frame firmly together, strengthening it *without the use of nails or rivets.*

This Screen is reversible, can be used either side up, gives a large purifying capacity; there is no clogging by foul lime, as the rattan presents a smooth surface and can be cleaned very easily. It is considered by all Gas Engineers who have used it to be the best Screen now in use.

☞ Samples sent Free to all Parts of the United States.

All communications should be addressed to

JAMES P. MAHAN,
19 Tremont Row, Room 5.
Boston, Mass.

384-6t

MECHANICAL & GAS ENGINEER.

To Gas-Light Co's.

The undersigned respectfully announces his voluntary resignation of the Vice-Presidency of the American Meter Company from the 1st of March last, after filling that position from its organization in 1863, and now offers his services as

Consulting or Constructing Engineer,

in the erection of new, or the extension of Gas Works.

He is prepared to furnish plans and Specifications, embracing all the latest improvements in the MANUFACTURE OF COAL GAS, at short notice, and on reasonable terms. His experience of THIRTY YEARS in the construction of Gas and Water Works, Railroads, Tunneling, etc., enables him to refer with confidence to any of the Works erected by him, as a guarantee of satisfaction and ability.

By arrangements with reliable manufacturers of all MATERIAL and SUPPLIES used by Gas Companies, he is prepared to furnish promptly all such orders, with best selections, and to give satisfaction as to prices, terms, etc., and respectfully solicits a share of patronage.

HENRY CARTWRIGHT, Gas Engineer,
2107 GREEN STREET, PHILADELPHIA. 379-6t

KIDD'S

Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York, Room 18,

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 cubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in Coal.	Per cent. of Ash in Coke.	Sulphur in Coke.	Sulphur in	Volatile Matter.	Specif. Gravity. Coal.	Specif. Gravity. Gas.
35.1	64.9	2	6	.82	1.48	.66	1,289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.
PERKINS & JOB, 27 South Street, N. Y.; 91 State Street, Boston.
H. W. BENEDICT & SON, New Haven.

MONONGAHELA
GAS COAL COMP'Y
Of West Virginia.

OFFICE, 56 EXCHANGE PLACE.
(P. O. Box 482.)
BALTIMORE.

Thomas Gemmell, *President.*
A. Robinson, *Vice-President and Treasurer.*
Benjamin Bissell, *Secretary.*

Mines at Wilsonburg, Harrison Co., W. Va
Shipping Port, Baltimore.

L. S. BOYER & CO, GENERAL SALES AGENTS.

The result of use of this coal in *quantity* by several of the largest gas works in the country, is reported as follows, viz. Yield of gas, 10,000 to 10 500 feet per ton of 2,240 lbs.; illuminating power, 16½ to 17½ standard candles; coke, good in quantity and quality. 350-3m

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 16,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superio Coke, with little Ash, and scarcely any clinker. 304-1y

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Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
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This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

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The best dry coals shipped, and the promptest attention given to orders. 294-1y

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

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Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 29 South street, } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

*** Reference to them is requested. 304-1y

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GAS COAL COM'Y
Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation, on most favorable terms.

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This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products."

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ENAMELED GAS AND WATER PIPE,

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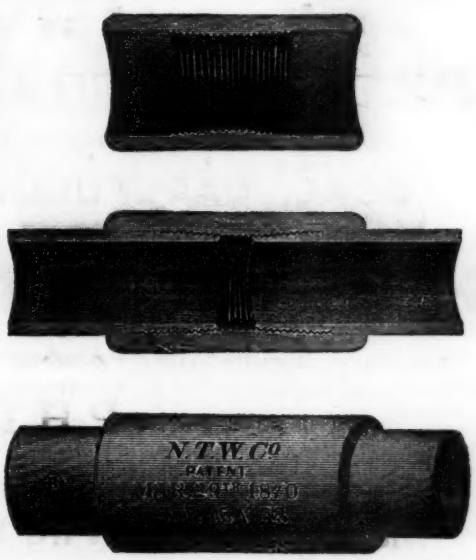

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The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

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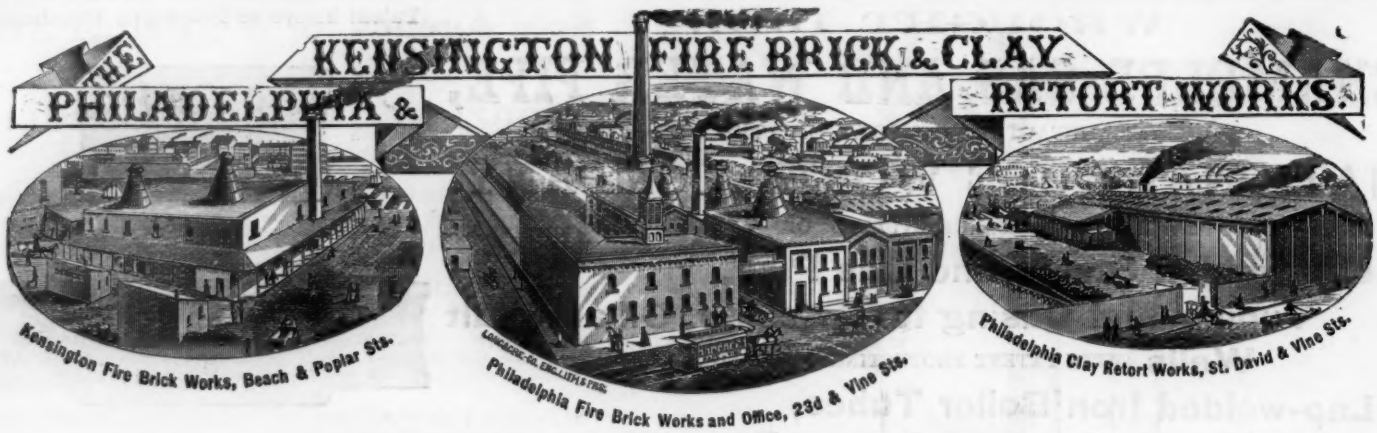
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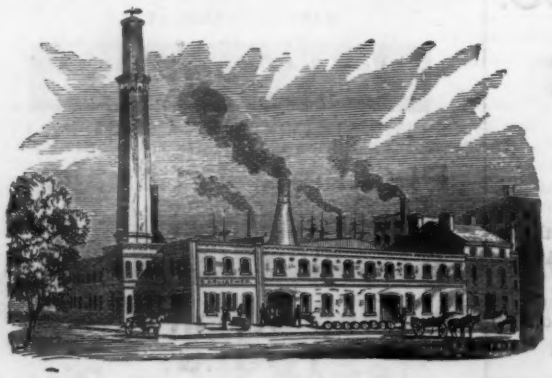

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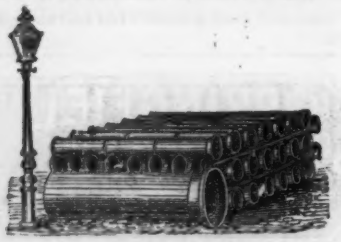

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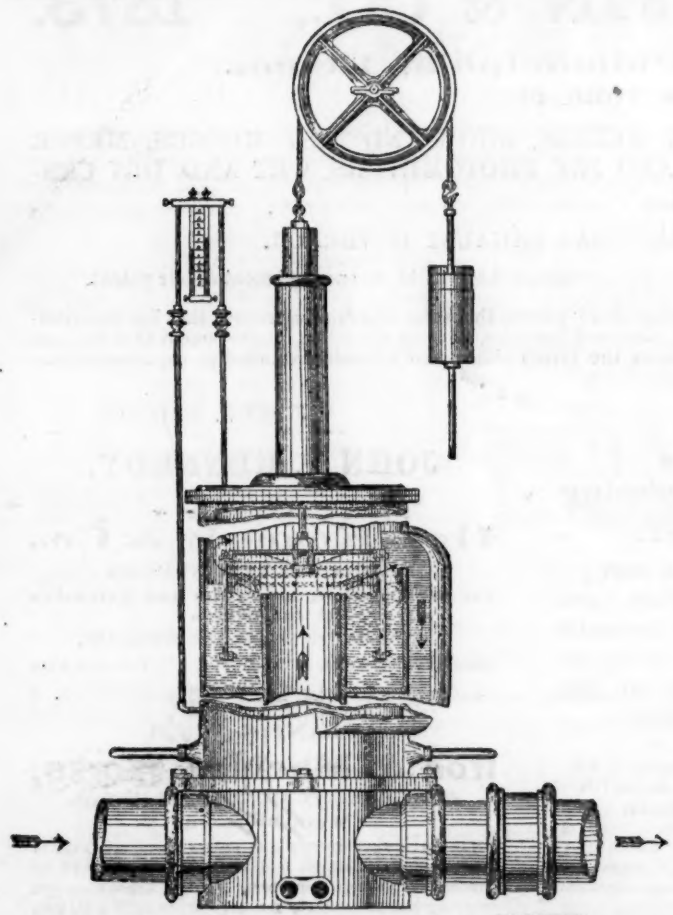

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With SMEDBERG'S COMBINED BYE-PASS, REVERSED FLOW, and DIFFERENTIAL GAUGE.

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This apparatus is based upon the recent discovery by Messrs. PELOUZE & AUDOUIN of the principle of Condensation by impact, or percussion.

All gas-makers are aware how difficult it is to separate all the Coal Tar and Water from Crude Coal Gas by mere cooling; and how frequently these liquids are swept on to the purifiers, even where scrubbers or washers of large size and considerable cost are employed.

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IT IS POSITIVELY GUARANTEED THAT EVERY CONDENSER SHALL BE OF PERFECT MECHANICAL CONSTRUCTION, AND SHALL DISCHARGE ITS FUNCTIONS SATISFACTORILY.

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Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500 $250 additional for each additional 50,000 per day.

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Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

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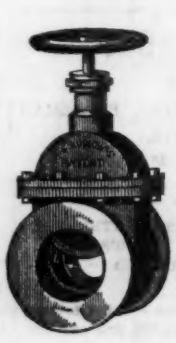

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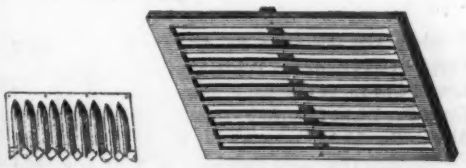

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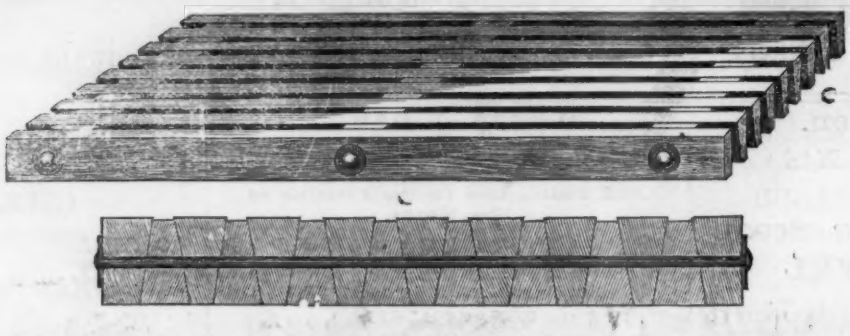

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